DEPLOYMENT OF NEXT-GENERATION ITS
– TREND OF ITS DEPLOYMENT IN JAPAN -

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ABSTRACT

In Japan, utilization of ITS is considered as one of new IT strategies of the government to support safe driving and smooth traffic flow, and various activities, such as deployment of ITS spots throughout the nation, have been enthusiastically carried out toward the widespread use of ITS.
In this document, the activities related to ITS in Japan, including the future direction of ITS in Japan, are reported from the various aspects.

1. PLANNING OF NEW IT STRATEGIES

Intelligent Transport System (ITS), which connects people, roads, and vehicles as a single system using the state-of-art ICT, realizes the advanced use of roads and greatly improves the safety of drivers and pedestrians, transportation efficiency, and conformability. Moreover, it significantly contributes to solving various social problems such as traffic accidents and traffic congestion, environment issues, and energy issues, etc. Furthermore, it is expected that advancement of ITS might create large new markets in the fields related to the vehicle industry and information communication industry, etc., and therefore it is considered as an important tool to advance innovation of economy in our country and produce new values.

ITS has been promoted in cooperation between four governmental bodies – National Police Agency(NPA), Ministry of Internal Affairs and Communications(MIC), Ministry of Economy, Trade and Industry(METI), and Ministry of Land, Infrastructure, Transport and Tourism(MLIT) and ITS JAPAN. With an aim at realizing safe, convenient, and eco-friendly traffic through the united efforts, the government established new IT strategies in May 2010 to further promote information communication technologies. Particularly, in the ITS field, it aims at halving the traffic congestion by 2020 compared to 2010 in major roads throughout the nation using ITS, etc., and also sets a higher target to accelerate the reduction of CO2 emission from vehicles. In addition, it sets “green transportation of people and goods” and “promotion of preventive measures for disasters, crimes, and accidents” as specific themes, which will be addressed through cooperation between the government and private sectors.

1.1. Green Transportation of People and Goods

In the theme of green transportation of people and goods, the targets are set to collect and distribute a wide range of road traffic information including real time vehicle driving (probe) information, and promotion of green ITS, which can be also applied to road traffic management. The schedule of the work by the government is shown below:

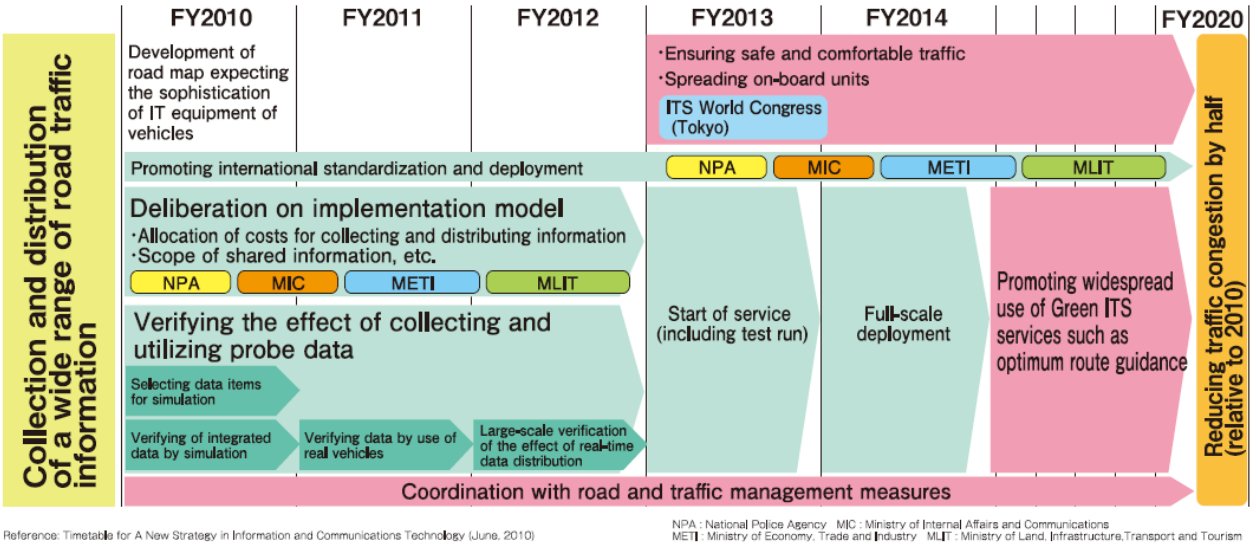

Figure 1 - Work schedule for green transportation of people and goods

1.2. Promotion of Preventive Measures for Disasters, Crimes, and Accidents

In the theme of promoting preventive measures for disasters, crimes, and accidents, the targets are set to introduce and adjust safe driving support systems which utilize the information communication technologies to reduce traffic accidents, etc. The schedule of the work by the government is shown below:

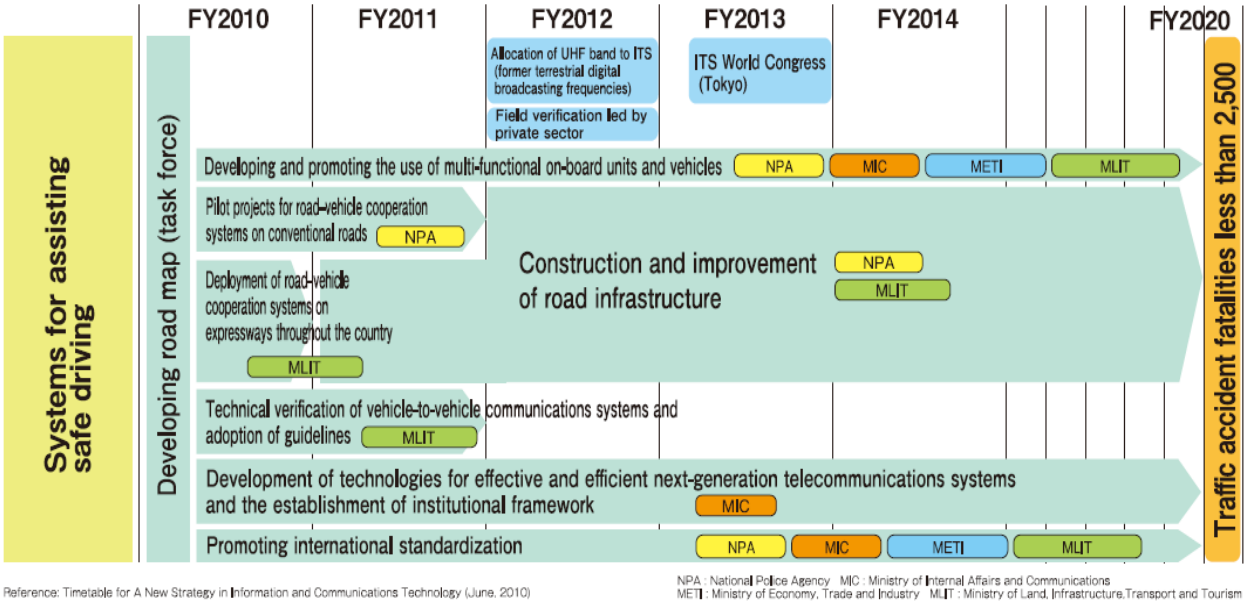

Figure 2 - Work Schedule for promotion of preventive measures for disasters, crimes, and accidents

2. CURRENT DEPLOYMENT OF ITS IN JAPAN

As one of the efforts to promote ITS in Japan, R&D and proving tests of a new cooperative vehicle-highway system have been conducted through industry-academia-government collaboration since “ITS for the Second Stage” was proposed in August 2004, and the nation-wide deployment of the ITS spot service started in March 2011.

2.1. Background of ITS Deployment in Japan

2.1.1 Advancement and Effects of Road Traffic Information

The total shipping units of car navigation systems exceeded approx. 38 million as of the end of December 2010. Among them, approx. 28 million units support VICS (started in 1996), which provides real-time road traffic information. VICS provides road traffic information such as travelling time, traffic congestion, and traffic restriction information, etc. to a car navigation system in real time, and it enhances drivers’ convenience, reduces CO2 emission and load on environment by resolving traffic congestion through appropriate route selection and by improving fuel consumption, contributing reduction of CO2 emission by 2.5 million ton annually.

2.1.2 Proliferation Promotion and Effect of ETC

ETC, which started its full-fledged operation in March 2001, has been steadily spread, and the number of the on-board units exceeded approx. 32 million as of the end of December 2010. Throughout the nation, 24 highway companies and road public corporations utilize a national standardized system, approx. 6.4 million vehicles per day use the system, and the utilization rate exceeds approx. 85%. Consequently, traffic congestion at toll booths, which accounted for about 30% of the entire traffic congestion in highways throughout the nation, has been almost resolved, and CO2 emission has been reduced by approx. 210,000 ton annually, contributing to reduction of burden on environment (Figure 3).

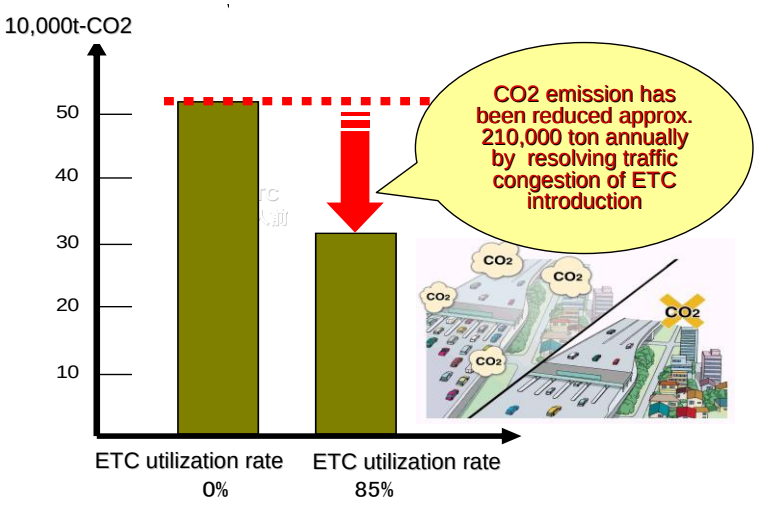

Figure 3 - Effect on reduction of CO2 emission

2.1.3 Promotion of Smartway

“Smartway” is a next-generation road traffic system incorporating ITS technologies that provide information to connect people, vehicles, and roads with the primary aim of ensuring traffic safety and reducing traffic congestions and burden on environment. In recent years, as part of Smartway, a next generation ITS service called the “ITS spot” has been deployed.

In Japan, research and development have been conducted to provide next-generation services using a cooperative vehicle-highway system through cooperation between government and private sectors to realize Smartway.

Establishment of an open platform has been targeted to provide a car navigation system and ETC, which have been provided in separate devices, in an all-in-one service, as well as dynamic route guidance and public services such as support for safe driving, and a wide range of services including settlement, sightseeing, and logistics, etc.

To realize this platform, using the international standardized high-speed and large-volume communication used for ETC, various services becomes available using the ITS spots installed in roads and corresponding car navigation systems installed in vehicles. (Figure 4)

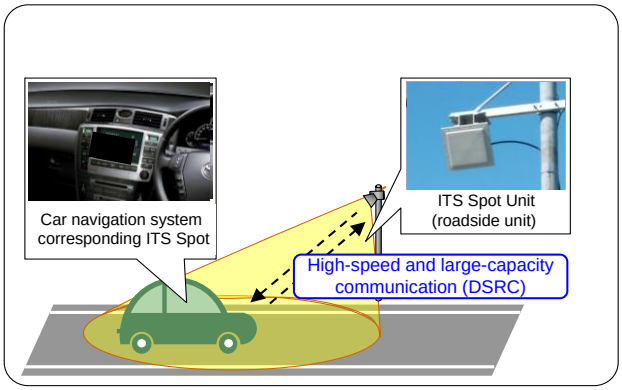

Figure 4 - ITS spots and corresponding car navigation systems

2.2. Nationwide Deployment of ITS Spot Service

2.2.1 Nationwide Deployment of ITS Spot Service

The ITS spot service started at part of metropolitan expressways in fall 2009. The ITS spots have been installed at approx. 1,600 locations, mainly at expressways throughout the nation, by March 2011, and the service has become available. (Due to Great East Japan Earthquake occurring on March 11, 2011), the start of the service has been postponed in Tohoku, Kanto, and Nigata (Figure 5). ITS spots are installed every 10 to 15 km of expressways between cities including the areas before approx. 90 junctions, and installed every 4 km of expressways within a city.

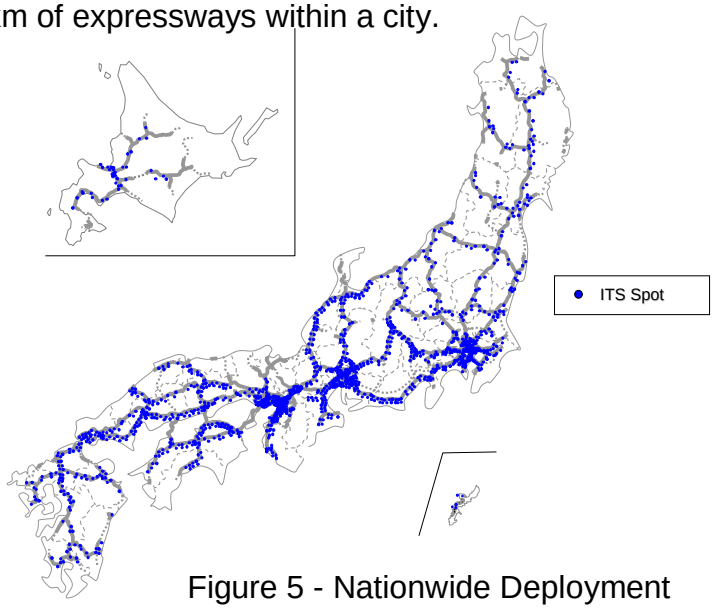

Figure 5 - Nationwide Deployment

2.2.2 Sales of Corresponding Car Navigation System

From fall of 2009, 5 private companies started selling car navigation systems which support ITS spots. With this system, the drivers can receive various services throughout the nation. It is expected that about 10 million units of the ITS spot support car navigation system will be sold in 5 years in total (Figure 6), and that the ITS-related market will be expanded to a 100 trillion yen market in total by 2020 with a trigger of the spread of ITS spots.

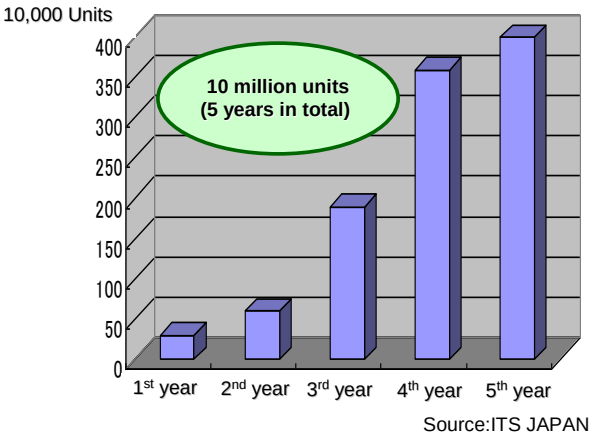

Figure 6 -Estimate of spread of corresponding car navigation system

2.2.3 Overview of ITS Spot Service

The ITS spot service enables three basic services through an all-in-one system using high-speed and large-volume communication between roads and vehicles. The overview of these services is explained below:

(1) Dynamic route guidance

Dynamic route guidance is a service of a real-time distribution of road traffic information such as the information of the expressways in wide areas crossing a prefectural border or the urban expressways in which various routes are available so that a car navigation system can smartly search and select the fastest route according to the latest information.
The use of ITS spots enables to provide information of wider areas than that of conventional FM-VICS. (Figure 7) Existing FM-VICS does not provide the road traffic information of adjacent prefectures, and there are non-sensable areas in expressways between cities. On the other hand, ITS spots provide the data of required time between sections of a maximum 1,000 km road in total length to a car navigation system. Using this data, a car navigation system can calculate the fastest route and give guidance at any time.

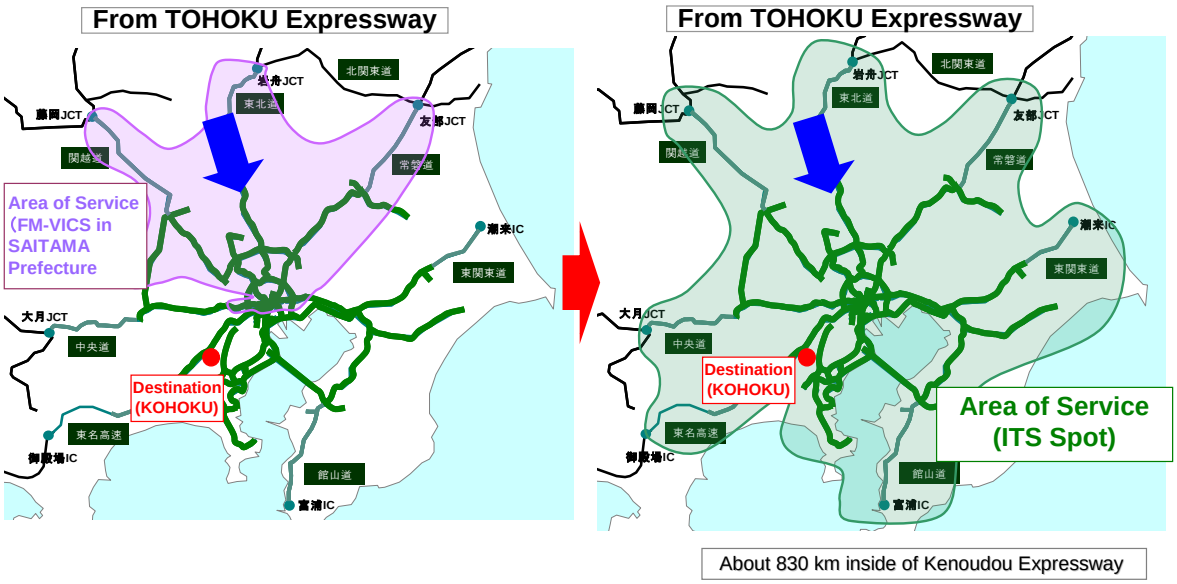

Figure 7 - Dynamic route guidance

For instance, when a driver returns home along Chuo Expressway to Chiba city, there are 33 possible routes. The driver can obtain all the data of expressways in the metropolitan area from the ITS spot at the point where the driver enters from suburb to the metropolitan area, and a corresponding car navigation system can find the fastest route.

In this way, ITS spots enable to select a route to avoid traffic congestion in the metropolitan area among various routes, enabling effective utilization of the whole road network.

(2) Support for safe driving

ITS spots can also provide information to support safe driving by responding to the safety risks of each road. For instance, in metropolitan expressways, 50,000 incidents of fallen objects are reported annually (1 incident occurs every 10 min). If ITS spots broadcast the information collected by the traffic control center at an appropriate timing when a vehicle is approaching a fallen object, it might be able to reduce near-miss incidents during driving.
It is also expected that calling an attention of drivers for unseeable traffic congestion ahead of a curve where an accident frequently occurs can reduce collision accidents. At the curve of Sangubashi, where an accident occurs most frequently in the Tokyo Metropolitan Expressway, the congestion information was provided on traffic information boards, and other measures were taken, and consequently accidents were reduced by about 60%. (Figure 8)
In addition, ITS spots will enable to notify the drivers of snow and fog, and congestion in a tunnel using images. (Figure 9)

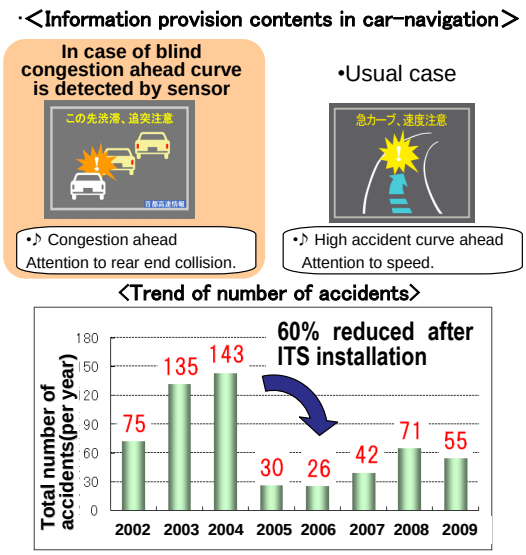

Figure 8 - Results of experiment at Sangubashi

(Direction is indicated by white arrow, and simplified location map is shown in right side of the screen)

Figure 9 - Example of image information to be provided

The ITS spot service has a function to store information in an on-board unit and provide the information to the driver at an appropriate timing. Therefore, it can provide safe driving information even at a place where an ITS spot is not installed but an accident frequently occurs.

(3) ETC

The ITS spot service utilizes the same communication technology for ETC and thus it can receive the conventional ETC service as long as a corresponding car navigation system is used.

(4) Other services

Some car navigation systems provide local sightseeing information and update car navigation maps.

2.3. Future Deployment of ITS

To establish an effective road plan and realize dispersion of traffic flow, probe information and other road traffic information will be collected to grasp highly accurate road traffic information and enhance road management. Moreover, an open platform will be established to offer various ITS services through public-private cooperation.

2.3.1 Cashless Settlement Using Credit Card

Using ITS spots will enable cashless settlement services for parking and drive-through payments (Figure 10). To realize cashless settlement, the National Institute for Land and Infrastructure Management has conducted research and development of a settlement device using an IC card, roadside equipment, and an on-board unit, and determined standard specifications for them in a public-private joint research in cooperation with 5 private companies started in November 2009, and conducted a proving test at Hibiya parking using these devices, which will be put in practical use, in December 2010. Based on the proving test, it will carry forward the research and development of the devices and also study the standard technology for wireless road-side equipment for EMV.

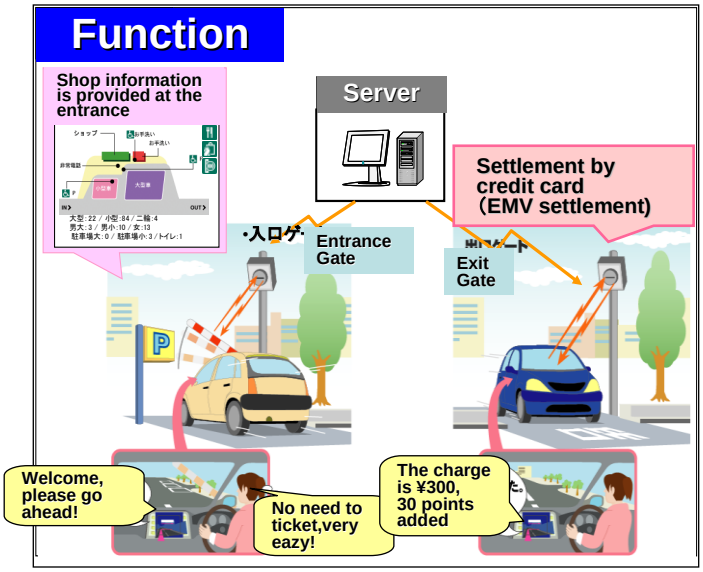

Figure 10 - Credit card settlement

2.3.2 Support for Logistics

Sending the vehicle position information, etc. from a vehicle to the center enables logistics service providers to grasp the position of vehicles. (Figure 11) These services will be studied through public-private cooperation.

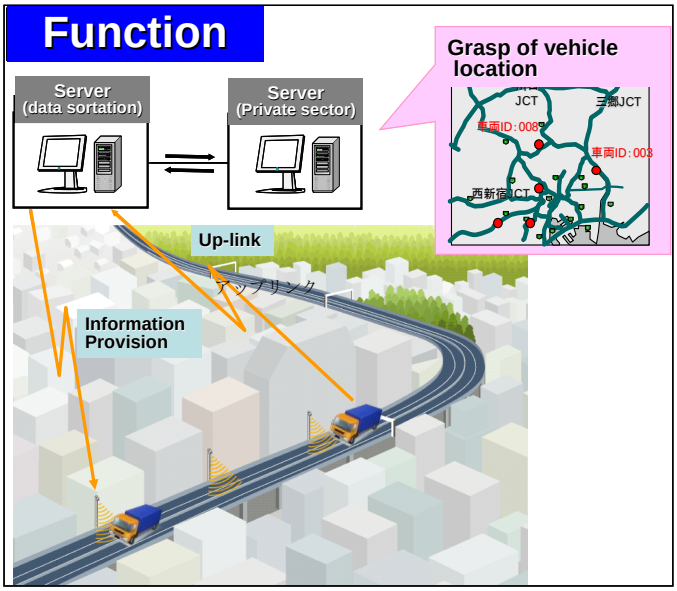

Figure 11 - Support for logistics

2.3.3 Measure for Traffic Congestion at Frequently Congested Sections and Sag Sections

Regarding the traffic congestion occurrence rate at inter-city expressways, the sag sections and tunnels account for approx. 60%. A means to effectively provide the driver with a warning to slow down, information on traffic congestion, and an instruction to use an appropriate lane when a vehicle is approaching a sag section or a tunnel will be studied.

2.3.4 Utilization of Probe Information in Road Management

Data such as the traffic volume and driving speed are essential to determine plans and assess policies for road maintenance and road management. Regarding the driving speed, the actual driving time between sections becomes available using the probe information, whereas the cross-sectional driving speed only was available before. In road management, there have been some cases where the probe information is used to assess policies.

For instance, the probe information is used to study the change in the traffic flow (e.g., Kyoto-Tanba expressway) in a social experiment to realize toll-free expressway. (Figure 12) In addition, the probe information can be also collected from the ITS spots to be operated throughout the nation, and application of the information to the future road management will be promoted.

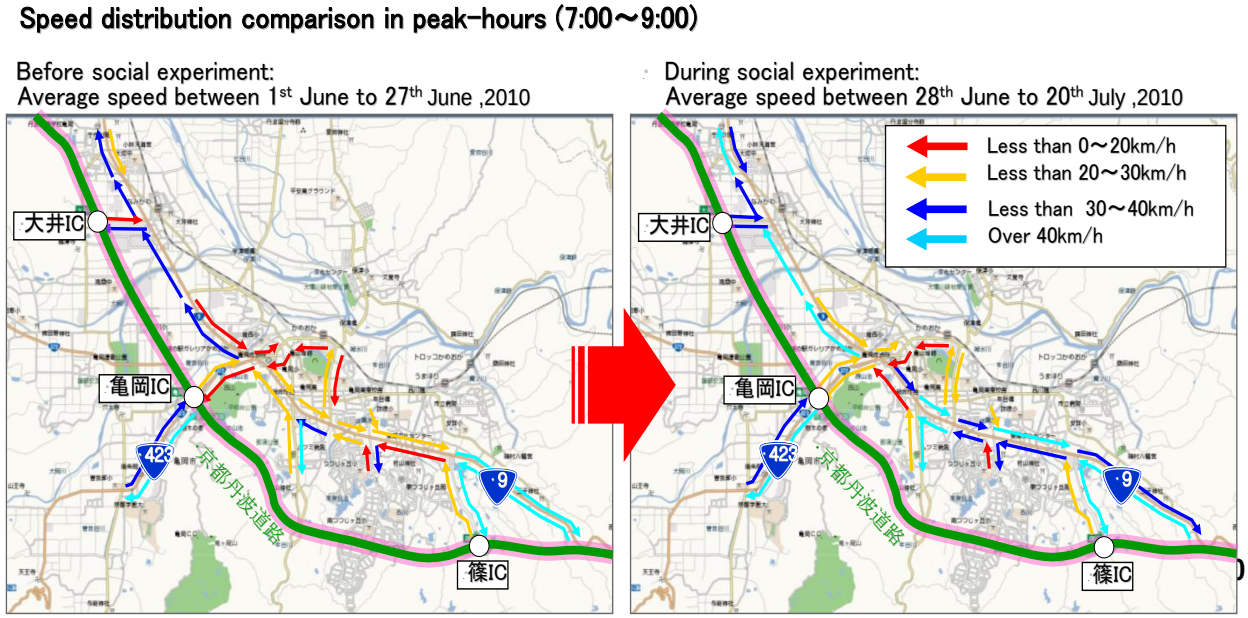

Figure 12 - Kyoto-Tanba expressway

2.3.5 Utilization of Probe Information at the Great East Japan Earthquake

At the time of the Great East Japan Earthquake on March 11, 2011, ITS Japan uploaded the traffic condition maps which reflect the actual traffic data provided by a vehicle manufacturer in its web site. Moreover, another map was created and uploaded which integrates the “Tohoku region road restriction information and disaster information collective map (provided by Geographical Survey Institute) ” which summarizes the closed road information provided by road administrators (Tohoku Regional Development Bureau, Iwate pref., Miyagi pref., Fukushima pref., and NEXCO East Japan). (Figure 13) This is an example of the future use of the probe information, and the use from the aspect of disaster prevention is also expected.

- **The blue colored line in following map indicates passable road detected by real-time probe-car data from 0:00 to 24:00 on 24th,April 2011.**
- **The red colored line and X-mark indicates closed road section/point from "Disaster information collection map in Tohoku region" (operated by Geospatial Information Authority of Japan) reported by each road administrators. (Last updated:17:00 on 24th.April 2011)**

Source:ITS JAPAN Website

Data provider（Probe-car data):Honda Motor Corporation, Pioneer Corporation,Toyota Motor Corporation, Nissan Motor Corporation,

Data provider(Road closure information):Tohoku Regional Bureau Ministor of Land,Infrastructure,and Transport, Iwate Prefecture, Miyagi Prefecture,Fukushima Prefecture,East Nippon Expressway Company Limited

Data integration:ITS JAPAN (nonprofit organization)

Figure 13 - Accessible road map

2.3.6 Support for Proliferation of Electric Vehicle, etc. (EV, PHV)

As support for proliferation of EV and PHV, a centralized system will be established on the Internet to collect and provide information on the quick charging facilities so that such information will be distributed and various bodies can utilize it through public-private cooperation. It will realize services such as car navigation guidance considering the remaining battery, enhancing the convenience of the user. In March 2011, the format and the like with which the companies who organize the charging facilities information (i.e., information organizers and providers) provide the information to the center servers, etc. managed by the companies who use the information (i.e., corporate information users) was stipulated, and “Specification for the Circulation of Information about Charger Facility for EV and PHV (draft)” which standardizes the information items required for collecting and providing the charging facilities information was created.

3. CONCLUSION

Tokyo will be hosting ITS World Congress 2013, which can be an important opportunity for Japan to make steady progress in ITS technology. Based on a nationwide recognition of the clear roles that ITS should play in our future life, we will promote the ITS development using all our public and private resources with a view to establishing a mobility society in Japan.