

Vehicle-Infrastructure Cooperative System and Probe Data in Japan

1. Start of ITS Spot service
2. Collecting probe data via ITS Spots
3. Utilizing probe data in road administration
4. Applicability to private-sector services
5. Public-private partnership on probe data

1. Start of ITS Spot service

- Vehicle-infrastructure cooperative system installed in 2011.
- Services provided via 5.8 GHz DSRC.

○Sales commenced in October 2009

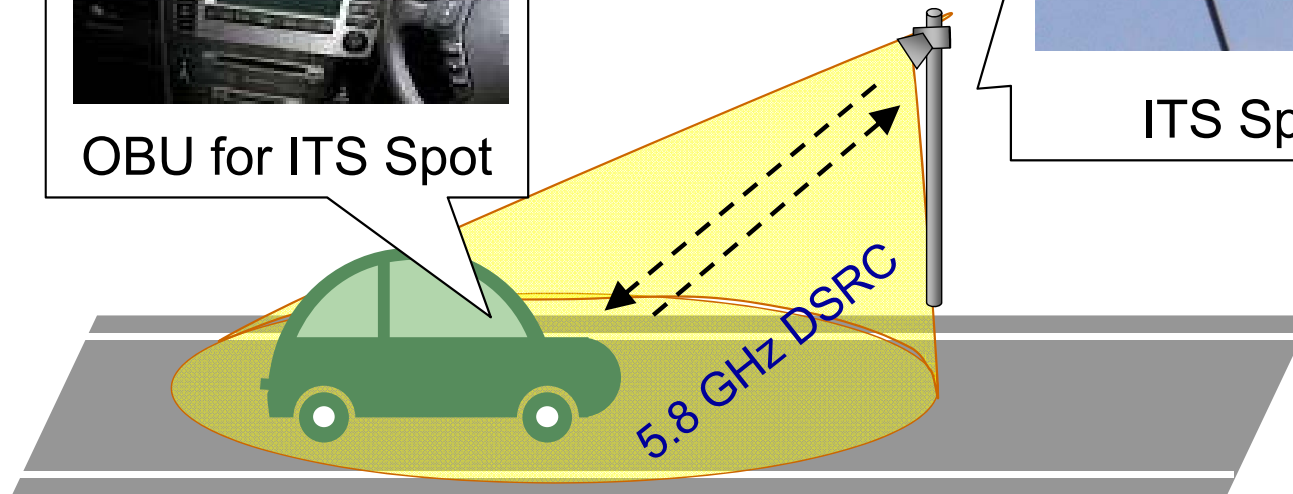


OBU for ITS Spot

○Deployed on expressways nationwide in 2011



ITS Spot

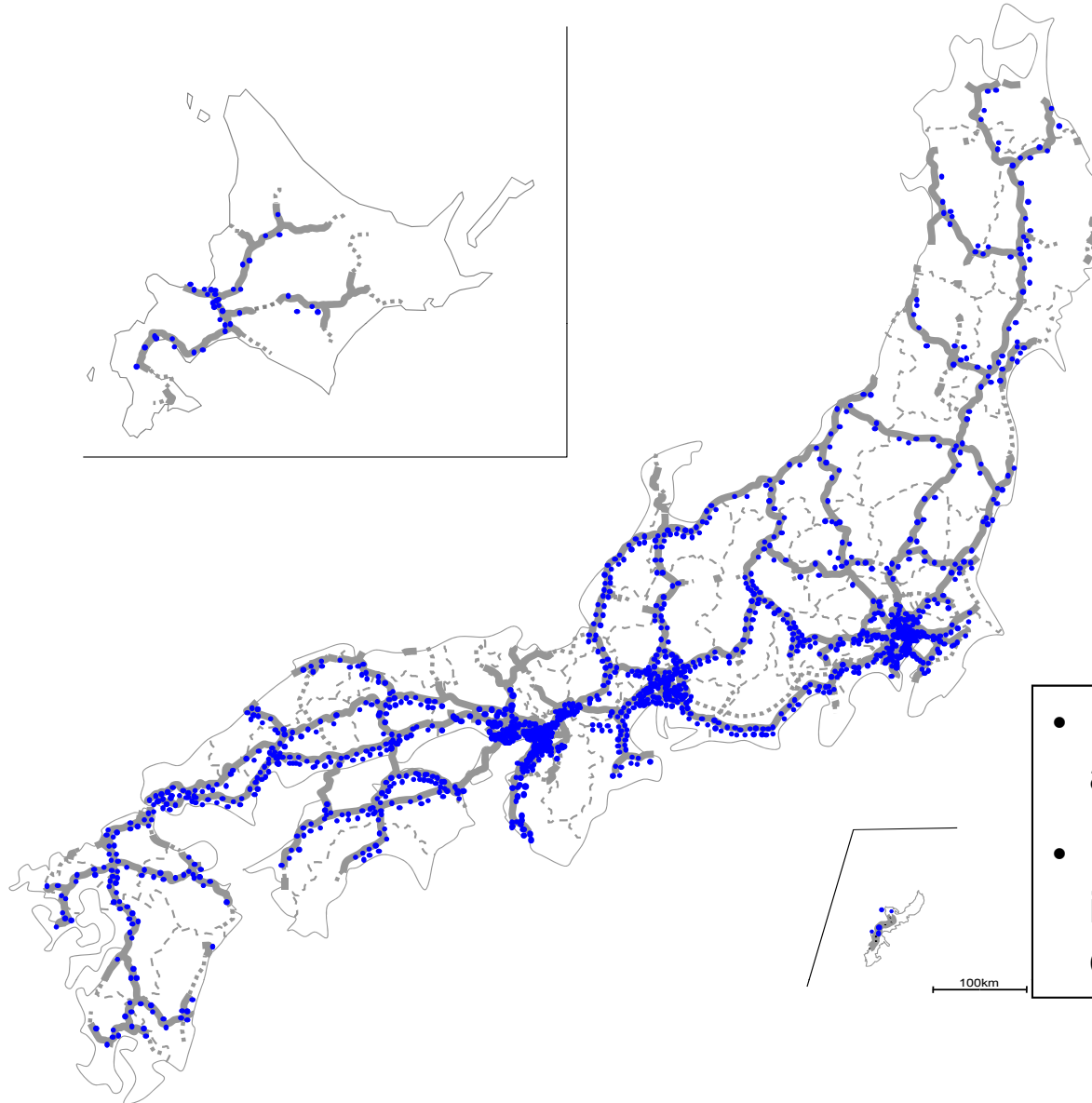


ISO 24103
ISO 29281

1. Start of ITS Spot service

Locations of ITS Spots

- 1,600 ITS Spots installed on expressways throughout all of Japan



- Installed at 10 to 15-km intervals along inter-city expressways
- Installed at approximately 4-km intervals along inner-city expressways

1. Start of ITS Spot service

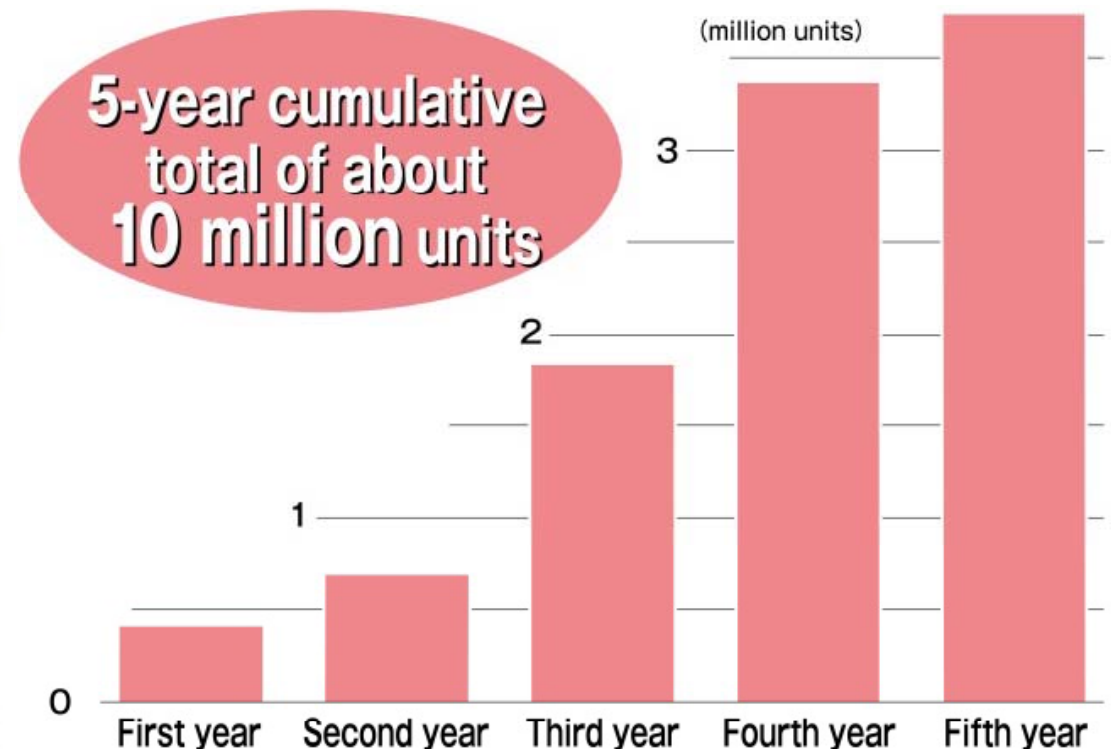
ITS Spot-compatible OBUs

- 16 manufactures marketed the compatible OBUs.
- 10M OBUs to be sold over 5 years.

Automobile manufacturers



Manufacturers of navigation systems and on-board units



Source: ITS Japan

- Three basic services and probe data collection started.

Three basic services

Dynamic route guidance: Wide-area congestion data for selecting routes intelligently.

Safety driving support: Alerting drivers to possible dangers.

ETC: Electronic toll collection

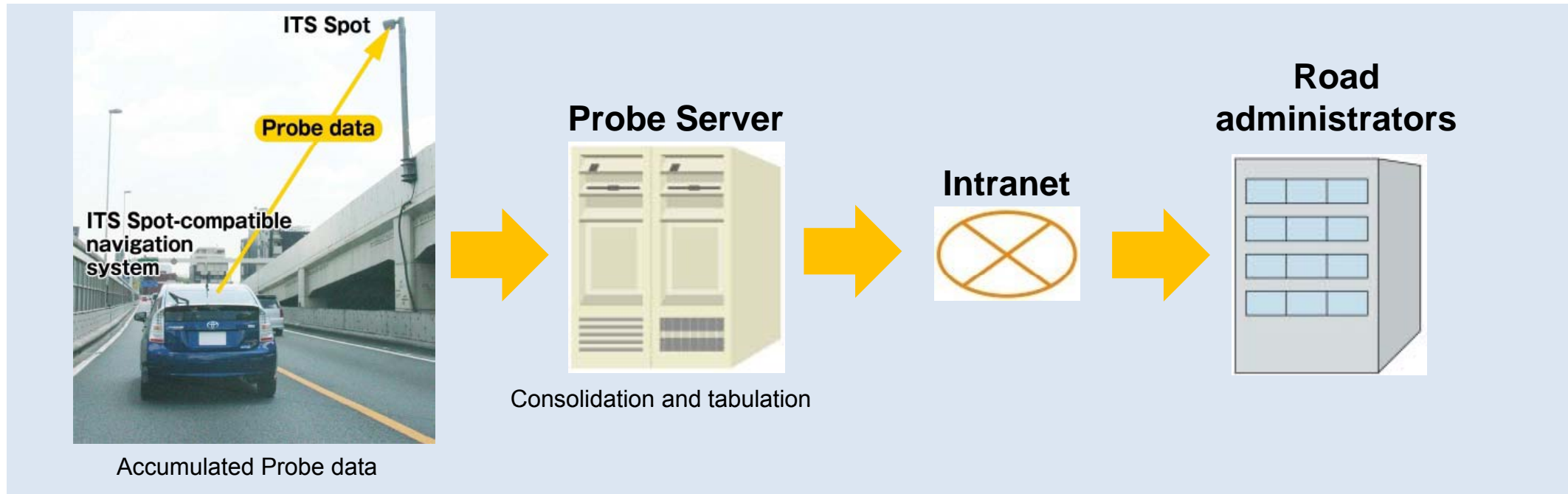
Collection of probe data: Collection of traveling data from individual vehicles

Other services (available with some manufacturer's OBUs)

Local sightseeing information via Internet.

*Additionally, services related to payments, tourism, distribution, etc., are planned for the future.

2. Collecting probe data via ITS Spots



- Data collected

- Travel data ; Time, location, speed
- Behavioral data ; Time, acceleration in all directions, yaw angle speed

- Timing of data recording

Location and speed: Every 200 meters of driving distance or when direction of travel changes by 45 degrees

Acceleration: When 0.25 G is surpassed

Yaw angle speed: When ± 8.5 deg/s is surpassed

- Data recording distance: Approx. 80 km

Protection of Privacy

1. Arrangement of the data to be transmitted

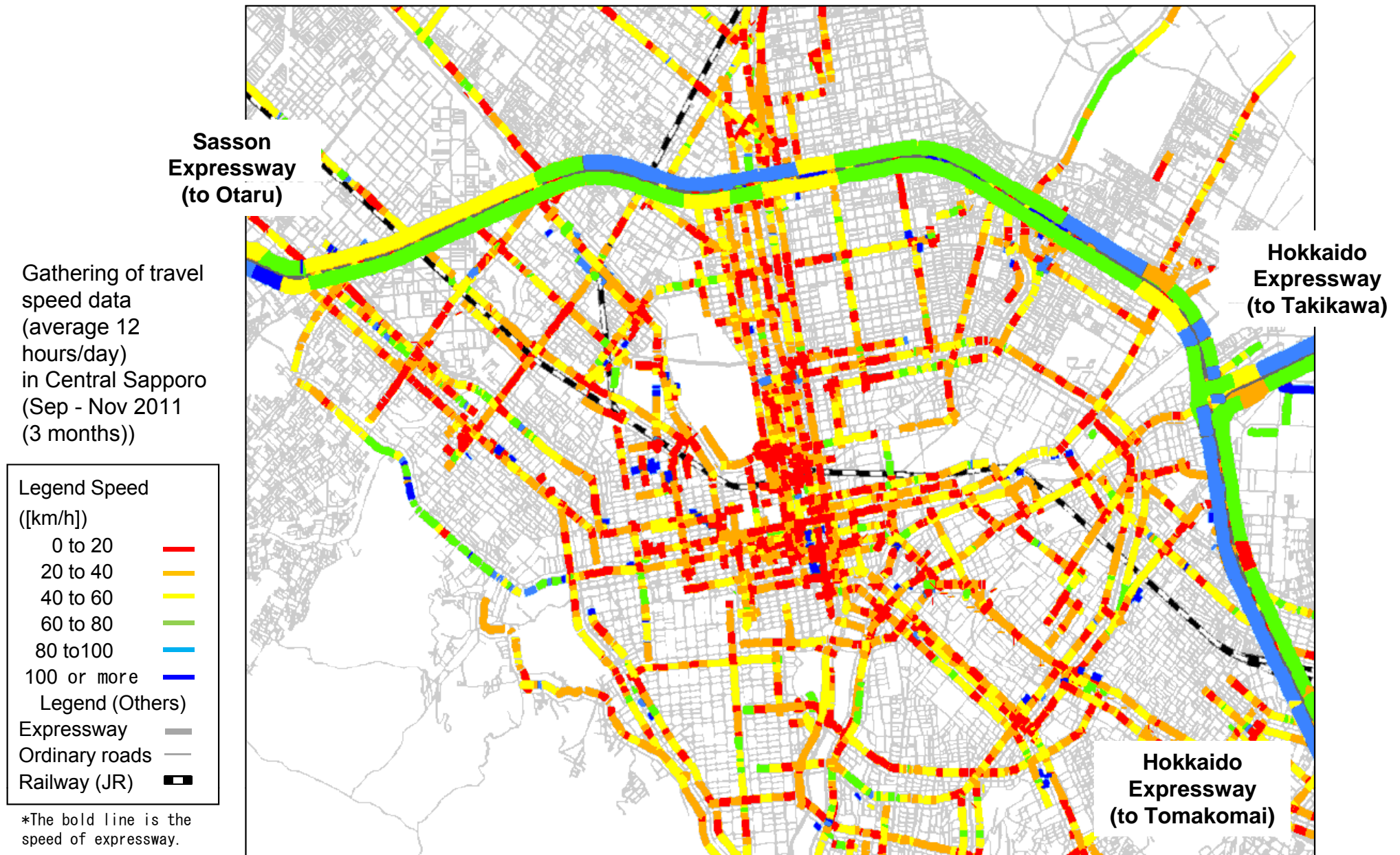
- Drivers and vehicles can not be identified.
- Probe data around the point where the engine stops will not be transmitted.
- Driver can choose not to transmit probe data.

2. Declaration of data usage

- Purpose of data usage is limited.
 - *Improvement of road management ,
Manufacturer's product development, research, etc.*
- Described in the instruction manual of OBUs and on the MLIT website.

2. Collecting probe data via ITS Spots

Processed probe data (Sapporo City)



3. Utilizing probe data in road administration

Probe data application menu

- Greater sophistication and efficiency to be achieved by travel records and behavioral records.

Use area	Forms of use
Survey and planning	<ul style="list-style-type: none">• Implementation of whole-area and continuous travel speed surveys• Performance measurement
Congestion countermeasures	<ul style="list-style-type: none">• Quantitative survey of congestion conditions• Clarification of effect of road construction on road traffic
Traffic safety measures	<ul style="list-style-type: none">• Analysis of travel conditions on community roads• Identification of potential hazardous points (accident-prone areas)
Management of large-vehicle passage	<ul style="list-style-type: none">• Survey of conditions concerning passage of special-purpose vehicles and vehicles carrying hazardous materials
Road management during disasters	<ul style="list-style-type: none">• Identification of passable route during disasters• Survey of passage conditions during snowfall
Provision of information	<ul style="list-style-type: none">• Increased sophistication of provided road traffic data

3. Utilizing probe data in road administration

Example of application in evaluation of road policy

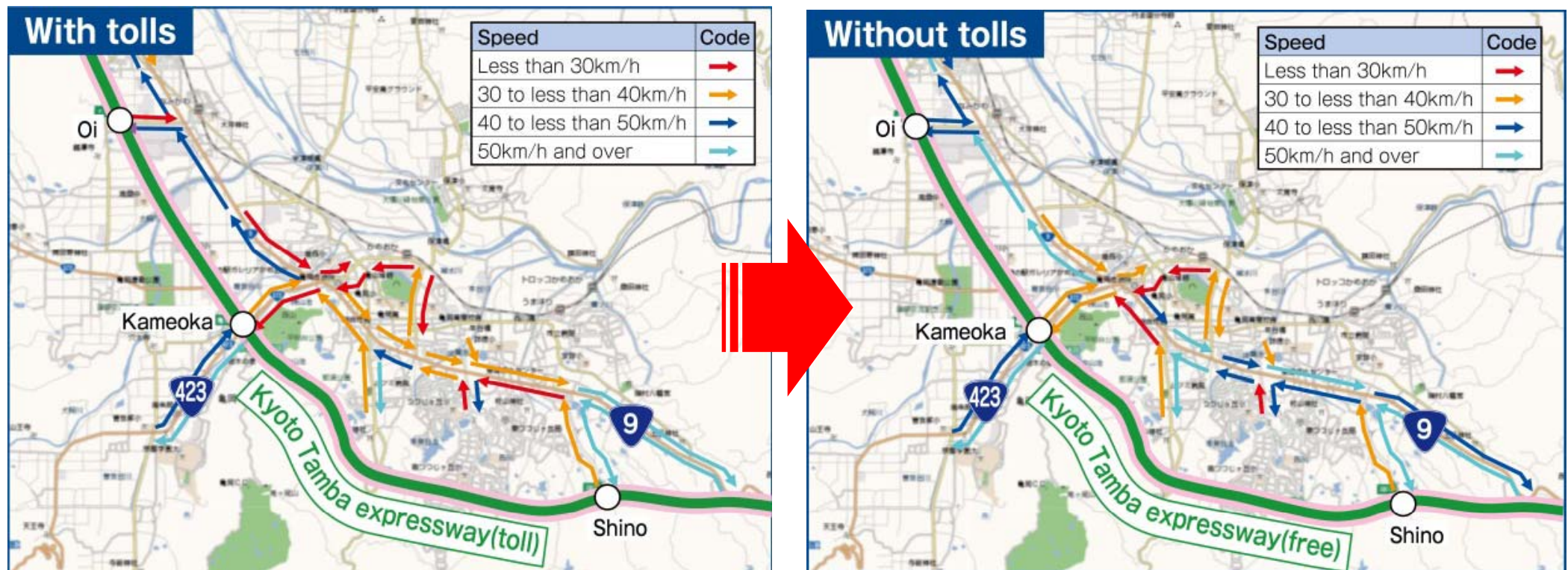
- Probe data used for evaluating road policy quantitatively.

Pilot project abolishing expressway tolls

Zone: 1,652-km zone

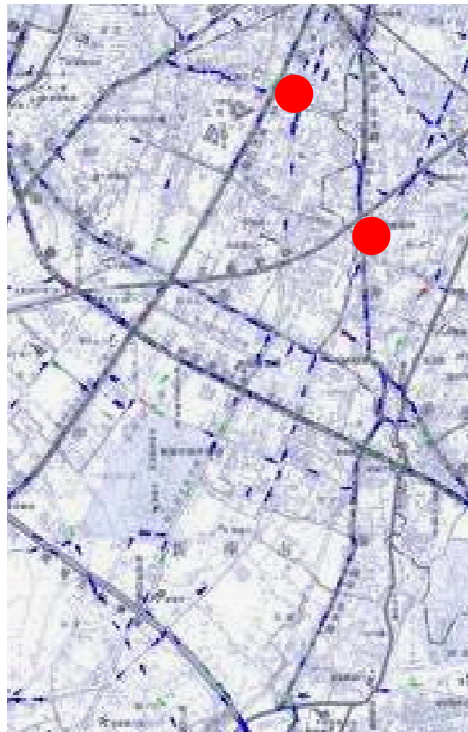
Period: June 28, 2010, to March 31, 2011

■ Change in speed during peak time periods



3. Utilizing probe data in road administration

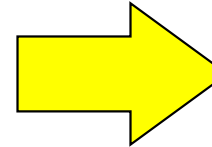
- Probe data indicates sudden braking points.
- Taking counter measures at such points can prevent traffic accident in advance.



Sudden braking point



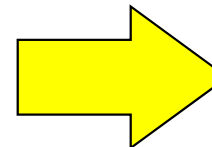
Treat the roadside plants



Sudden braking point



Painted road marking



● : Sudden braking point

Sudden braking reduced by 70%

3. Utilizing probe data in road administration

Example of application during a disaster

- Probe data used for estimating passable routes.
(Great East Japan Earthquake)
- Selecting routes for emergency transport vehicles and relief supplies.



— : Actual traveled route
(provided by private-sector makers)

— X : Road closure
(provided by road administrator)

Information on vehicle-taveled route provided by
:Honda Motor Co., Ltd, Pioneer Corporation, Toyota
Motor Corporation, and Nissan Motor Co., Ltd

Closed road section data provided by
:Tohoku Regional Bureau, Iwate Prefectural
government, Miyagi prefectural government,
Fukushima prefectural government, and East
Expressway Co., Ltd,

Data integrated by: Non profit organization ITS Japan

Data on traveled route and route closure

Support for distribution business

- Probe data of each logistic vehicle is collected at ITS Spots free of communications charges, and provided to the logistic center real-time.
- Physical distributors use the probe data for controlling vehicular operation and guiding each driver for safe driving.



List of Sudden braking point

■ : Travel route ○ : Sudden braking point



Time Position Acceleration Travel speed

The Study Group of Consumer Electronics Logistics
(Organizer: MITSUI-SOKO-LOGISTICS Co., Ltd.)

Joint research on Probe data

Purpose

Take advantage of the probe data collected through ITS Spots in conjunction with industry.

- (1) Technology development for the use of Probe data
- (2) Validation of the effects of introducing service
- (3) Creating a technical standards and institutional framework

Period

September 2012 ~ March 2015

Request for proposal June ~ July, 2012.

Proposal submitted 7 companies.

Now, in preparation for a joint research agreement.



Results to be expected

Clarification of the use of effective service.

Improved easiness of utilization.

→ Practical Service !

5. Public-private partnership on probe data

- Private sector is also collecting probe data and creating various services.
- Quality and quantity of such data is usually undisclosed.

	Car companies	Cellular application	Taxi companies
Collection method	Cellular phone	Cellular phone	Business-use radio
Data items collected	Time stamp Latitude / Longitude Speed (Partly undisclosed)	Time stamp Latitude / Longitude Speed	Time stamp Latitude / Longitude (Partly undisclosed)
Number of target	Partly Undisclosed	Unknown	Unknown
Quantity of data	Undisclosed	Undisclosed	Undisclosed
Accuracy of data	Undisclosed	Undisclosed	Undisclosed

Next Steps

■ Probe data collected through ITS Spot

- Realization of private services through joint research.
- Establishment of rules to use probe data.
 - *Format to be provided, Personal information protection, etc.*

■ Probe data collected by private sector

- Necessary to compare the quality of probe data.
 - *Accuracy, Amount of data, Availability of real-time data, etc.*
→ *this is an area of competition.*
- Further study for new application aiming efficient road administration.
 - *Analysis of traffic behavior including a variety of transportation modes, Optimal transportation planning.*
 - *Analysis of time loss due to congestion by road work, Adjusting the timing of road work, etc.*