Up-date of Intelligent Transport Systems in Japan

Ministry of Land, Infrastructure, Transport and Tourism Japan

14 October 2013
ITS is designed to integrate people, roads and vehicles in order to resolve road traffic problems such as traffic congestion, traffic accidents and environmental degradation.

- Environmental degradation:
  - 19.6% of all CO$_2$ emissions in transport sector (2011)

- Traffic congestion Time loss:
  - 5 billion hours annually

- Traffic accidents:
  - 660,000 accidents resulting in 4,400 fatalities (2012)
Organizational Structure to Promote ITS in Japan

Organizational structure to promote ITS

Comprehensive Plan

1. Advances in navigation systems
2. Electronic toll collection systems
3. Assistance for safe driving
4. Optimization of traffic management
5. Increasing efficiency in road management
6. Support for public transport
7. Increasing efficiency of commercial vehicle operations
8. Support for pedestrians
9. Support for emergency vehicle operations

Orange indicates efforts in which MLIT is particularly actively involved.

Four ITS related ministries
- MLIT: Ministry of Land, Infrastructure, Transport and Tourism
- NPA: National Police Agency
- MIC: Ministry of Internal Affairs and Communications
- METI: Ministry of Economy, Trade and Industry

ITS Standardization Committee
*Promotion of ITS by the industry and academia composed of knowledgeable persons, private parties, etc.

ITS Japan

Government Policy on ITS

“Declaration on the Creation of the World’s Most Advanced IT Nation”

(Approved by the Cabinet Meeting on June 14, 2013)

• Short term:
  - Studying a system to achieve automated driving on expressways
  - Expanding the use of ETC and other ITS technologies

• Middle/Long term:
  - Research to advance driving support technologies by using road structure data etc.

• Target goals:
  - Fewer than 2,500 traffic accident fatalities (2018)
  - World’s safest road traffic society (2021)
VICS, ETC, and other ITS services were achieved by providing digital road maps (DRM), promoting development and introduction of roadside devices, and forming a promotion organization linking concerned ministries and agencies and linking the government and the private sector.

Promotion through government – private sector collaboration

- **Digital road maps (available since 1990)**
  - **G**: Government
  - **P**: Private sector
  - Promotes standardized specifications
  - Provides the maps (with government assistance)
  - Develops products to use the maps

- **VICS (available since 1996)**
  - **G**: Government
  - Provides techniques and standards for collecting and distributing road traffic information
  - Develops instruments for collection systems and center systems
  - Develops VICS-capable car navigation systems

- **ETC (available since 1997)**
  - **G**: Government
  - Provides techniques for cashless transactions services
  - Supports incentives to promote the wide use of discount measures, etc.
  - Develops OBU and conducts campaigns to promote their use

Penetration of...
- Car navigation
- VICS on-board units
- ETC on-board units
Widely deployed ITS Service in Japan - VICS -

**VICS: Vehicle Information and Communication System**

- **Police Department**
- **Traffic Information Center**
- **Road Operator**
- **Infrared Beacon**
  - Local traffic information up to 30km ahead is sent at major intersections.
- **Radio Beacon**
  - Highway traffic information up to 200km ahead is sent through DSRC beacons.
- **FM Multiplex**
  - Regional traffic information is broadcast through FM radio station.

VICS services begin in April 1996
- provides road traffic information (congestion, accident, etc.) on car navigation screens.
- Cumulative shipments of VICS OBU exceed 37 million units (March 2013)

Display of a VICS compatible car navigation system
(Red lines indicate congestion)

Cumulative shipments of VICS

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**ETC: Electronic Toll Collection system**

- Equipped on more than 41 million vehicles (March, 2013)
- Usage rate is about 89% (Aug, 2013)
- More than 7.3 million vehicles per day use ETC (Aug. 2013)

*Cumulative total of new setups = [Total setups] - [Re-setups]*

Calculated by the data on website of Organization for Road System Enhancement

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ETC introduction has eliminated almost all toll-gate congestion on expressways (30% of all expressway congestion).

Ex. of congestion reduction

Widely deployed ITS Service in Japan - ETC -

Reduction of CO₂ by introduction of ETC

2000 without ETC

Prepared based on totals for three NEXCO companies
(congestion amount = number of congestion incidents \times average congestion time \times average maximum congestion length / 2)

2009 with ETC

Source: H23 ETC Handbook Simplified version

Brand-new ITS service - ITS Spot Services -

2004
- Smartway Project Advisory Committee
  “ITS Enter the Second Stage”

2005
- Start of joint researches

2006
- Final report of joint research
- ITS on-board unit standard (JEITA standard)

2007
- On-road tests on Tokyo Metropolitan Expressway
- Smartway 2007 Demo on Tokyo Metropolitan Expressway

2009
- ITS-Safety2010 Large scale demonstration
- Releasing ITS Spot-compatible car navigation units

2010
- Technical Specification for roadside equipment

2011
- Installation of about 1,600 ITS Spots

Launching of nationwide ITS Spot Services
Deployment of ITS Spot Service

Locations of ITS Spot

- More than 1,600 ITS-spots have been installed

ITS Spot compatible on-board units retailers

<As of 5 Sep 2013>

Car manufacturer

- TOYOTA
- NISSAN
- MITSUBISHI MOTORS
- MAZDA
- SUZUKI
- SUBARU
- HONDA
- PEUGEOT
- CITROËN
- Mercedes-Benz
- Volkswagen
- Audi
- FIAT
- CHRYSLER
- Ford

Electrical equipment manufacturer

- ALPINE
- Pioneer
- Panasonic
- MITSUBISHI
- Clarion
- DENSO
- JVC KENWOOD

More than 150,000 OBUs

<as of 30 Sep 2013>

Day-one services for users

Dynamic route guidance
Receipt of wide-area congestion data allows car navigation system to select routes intelligently. 

Safe driving support
Reduction of close-call experiences by alerting drivers to possible dangers such as fallen obstacles on roads. 

ETC
Realization of ETC services. 

Collection of probe data
Collection of traveling data from individual vehicles
Ex. Safe Driving Support

Information on road-work, traffic restriction & obstacles

On the Metropolitan expressway, one obstacle every 10 minutes

Congestion tail information
60% of collisions have been reduced at Sangubashi Curve.

Still image information
On-board display shows still image on weather conditions such as snow and fog and traffic.
V2I Services at Expressway Sag Sections

- V2I services at expressway sag sections consist of a roadside sensor which observes traffic conditions and a roadside ITS Spot which provides ACC setting information.
- If the traffic volume exceeds a certain threshold value, ACC setting information will be provided by roadside ITS Spot.

Towards next step…
- It is estimated that if 20% of vehicles practice "traffic-smooth driving" in a sag section, congestion can be reduced by nearly 25%.

Simulation calculation conditions:
- Calculation results based on data on the small-scale congestion (0-15 km/h) that occurred in the Yamato sag section of the Tomei Expressway in 2011.
- Lost time is calculated by $\sum \text{Max}[\text{Travel time} - \text{Base travel time} (\text{assumed to be 70km/h})]$, 0.
- The average following gap of vehicles practicing traffic-smooth driving at the downstream and the upstream of the sag section are about 1.75s and about 1.5s, respectively. And they follow the leader vehicle quickly than other vehicles so as to keep constant following gap.
Towards next step...

- Efforts to collect information on travel routes of vehicles

Collect travel routes & frequency info. → Planning ring road utilization measures, etc. → Implementation → Check on travel routes & frequency info.

Outline of probe data application

Regularly collecting info. on the travel routes & frequency of vehicles and working out measures to make effective use of ring roads and assist in vehicle operation.

Future plans

Developing systems for collecting vehicle travel data from ITS Spots and regularly collecting info. on travel routes & frequency of vehicles.

Field trials will be conducted to verify OBU functions and collected route information accuracy.

DSRC OBU with GPS

passenger vehicle

large vehicle

Fully utilization of the three ring roads is essential to realize expected benefit.

- **Traffic easing**
  - *600 points* of traffic congestion will be almost disappeared
  - Average value for travel speeds to traffic congestion
    
    $18.8 \text{km/h}(2005) \Rightarrow 25 \text{km/h}(2015)$

- **Reduction of travel time (Shinjyuku ~ Haneda)**
  - 40 min $\Rightarrow$ 20 min

- **Environmental improvement**
  - $\text{CO}_2$ discharge reduction:
    
    $2$~$3$ million t/year
Thank you for your attention.
Merci de votre attention.
ご清聴ありがとうございました。