Recent ITS Development in Japan

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JAPAN
1. ITS Development in Japan

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990'</td>
<td>V to I Applications • Traffic information • Electric toll collection • Safety driving support</td>
</tr>
<tr>
<td>1996</td>
<td>Car navigation 59 million units ship(2013.12)</td>
</tr>
<tr>
<td>2000</td>
<td>VICS 41 million units ship(2013.12)</td>
</tr>
<tr>
<td>2011</td>
<td>ETC 45 million units ship(2013.12)</td>
</tr>
<tr>
<td>2014</td>
<td>ITSpot Various applications • Wide area traffic information • Safety driving support • ETC</td>
</tr>
</tbody>
</table>

**Evolve into**
- Upgrade of existing service
  - Still images
  - Weather data
  - Information on local tourist spots, etc.
- New service
  - Tolls for individual routes
  - Commercial vehicle management

**Vehicle Automation**
- 1996: Platoon demonstration test using lane maker etc.
- 2012: Truck platoon demonstration test using radar, camera etc.

**Auto-pilot System Study Group (MLIT)**
- 2013: Interim Report Released

**Government-wide SIP Research Project**
- 2014: R&D Plan Released
2. ITS Spot service

- Roads and vehicles are connected to each other via high-speed and large-capacity communication.

Compatible Navigation System

ITS Spot Roadside Unit

5.8GHz DSRC
High-speed and large-capacity communication

Sales commenced in October 2009

Deployed on expressways nationwide in 2011

ISO 24103
ISO 29281
2. ITS Spot service

Locations of ITS Spots and ITS Spot-compatible OBUs

- 1,600 ITS Spots installed on nationwide expressways
- A total of 24 automobile, car navigation system and OBU manufacturers offer ITS Spot compatible car navigation systems.
- As of July 2014, 360,000 OBUS has been installed.
2. ITS Spot Service

**Dynamic Route Guidance**
- Provide wide-area traffic congestion data to enable car navigation systems to select routes smartly

**Safety Driving Support**
- Reduce close-call experiences by alerting drivers in advance

**ETC**
- Reduce congestion at expressway toll booths

**Other services**
- **Cashless payment**: Automatic fee payment at parking lots, automatic gate opening and closing (no need to roll down the window and pull over).
2. ITS Spot service

ITS Spot service: Dynamic Route Guidance

- Receive wide-area road traffic information

There are many route choices for drivers heading for the destination through central Tokyo.

Selecting the best route is difficult for drivers.

Travel time data for all road segment in the metropolitan area are received.

The traffic conditions of whole road network can be considered.

The navigation system can smartly select the best route.
2. ITS Spot service

ITS Spot Service: Safety Driving Support

- Alert drivers in advance

(1) Alert drivers to the existence of congestion behind a blind curve

(2) Alert drivers to the existence of obstacles ahead

(3) Provide road and traffic conditions by still pictures in real time

- About 60% reduction of rear-end collision at the Sangubashi Curve on the Metropolitan Expressway
- Weather condition at a few km further
- Traffic congestion in tunnels

50,000 obstacles / year in Metropolitan expressway (one obstacle every 10 minutes)
3. Utilizing probe data in road administration

Collecting probe data via ITS Spots

- Probe data stored in the ITS Spot-compatible OBU is uplinked when the vehicle passes under an ITS Spot.

![Fig. Schematic diagram of probe data collection system](image)

Collected probe data:

- **Travel record**: time, position (longitude, latitude), speed → stored every 200m, or every 45° changes of the driving direction
- **Behavior record**: time, acceleration, speed, yawing angle → stored when the acceleration exceeds the threshold value
3. Utilizing probe data in road administration

Collected probe data Amount

- Nearly 23,390,000 vehicle kilometers travelled (VKT) probed data are collected every month.

[x 1,000 VKT/month]
3. Utilizing probe data in road administration

As the locations of traffic congestion can be determined from the probe data, it is possible to devise appropriate measures to reduce congestion, and to assess their effectiveness after they have been introduced.

Example of analysis
The status of traffic congestion near the Sakuramachi intersection on National Route 50 was determined, and measures including the creation of a right-turn lane were devised. After the measures were implemented, the effectiveness of these measures was analyzed.

It was confirmed that chronic congestion had been eliminated.
3. Utilizing probe data in road administration

○ Probe data show the speed at which drivers drive at each location, so it is possible to identify bottlenecks where traffic congestion occurs.

◆ Example of analysis
Using probe data, the locations of bottlenecks where congestion occurs are identified and effective measures are devised.

Using a traffic counter, it was determined statistically that traffic congestion begins near the Kamiyashiro IC. From the probe data, however, it was determined that the actual bottleneck is the sag near the Hikiyama IC.

◆ Example of analysis
Using probe data, the locations of bottlenecks where congestion occurs are identified and effective measures are devised.
4. Smart Use of Expressway Network in Japan

Road transport challenge

- **Congestion**
  40% of the total driving time are lost due to traffic congestion. (40 hours per person each year)

- **Emission**
  The catalog mileage for Japanese vehicles is among the highest in the world, but actual driving mileage is only one-half the catalog mileage.

- **Inadequate highway network**
  Proportion of expressway sections with 3 or fewer lanes
  - Japan: 31.9%  US: 5.1%  UK: 01%

- **Unfeasible to expand network on a large scale**
  - **Fiscal constraint**
    Not enough resource for capacity building
  - **Spatial constraint**
    Limited space for road way in density – populated big cities and due to mountainous rural regions

Ring Expressway Network in big cities will soon be completed.

Solution

Smart use of the existing expressway network with ITS

Due to traffic congestion

Standard amount of time
(8 billion hours)

Additional time
(5 billion hours)

40 hours per person
### Traffic volume on expressway network must be optimized

#### Expressways

<table>
<thead>
<tr>
<th>Route</th>
<th>Morning (7-10 a.m.)</th>
<th>Midday (11 a.m. - 2 p.m.)</th>
<th>Late Afternoon (3-6 p.m.)</th>
<th>Evening (7-10 p.m.)</th>
<th>Average speed (7 a.m. - 6 p.m.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inner Circular Route</td>
<td>1,594</td>
<td>1,439</td>
<td>1,442</td>
<td>1,016</td>
<td>42 (km/h)</td>
</tr>
<tr>
<td>Central Circular Route</td>
<td>1,508</td>
<td>1,454</td>
<td>1,475</td>
<td>912</td>
<td>49 (km/h)</td>
</tr>
<tr>
<td>Tokyo Gaikan Ring Expressway</td>
<td>1,394</td>
<td>1,134</td>
<td>1,279</td>
<td>656</td>
<td>69 (km/h)</td>
</tr>
<tr>
<td>Metropolitan Inter-City</td>
<td>513</td>
<td>421</td>
<td>514</td>
<td>221</td>
<td>74 (km/h)</td>
</tr>
</tbody>
</table>

#### Ordinary roads

<table>
<thead>
<tr>
<th>Route</th>
<th>Morning (7-10 a.m.)</th>
<th>Midday (11 a.m. - 2 p.m.)</th>
<th>Late Afternoon (3-6 p.m.)</th>
<th>Average speed (7 a.m. - 6 p.m.)</th>
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</thead>
<tbody>
<tr>
<td>Ring Road No. 7</td>
<td>725</td>
<td>706</td>
<td>700</td>
<td>424</td>
</tr>
<tr>
<td>Ring Road No. 8</td>
<td>539</td>
<td>515</td>
<td>523</td>
<td>403</td>
</tr>
</tbody>
</table>

#### Definitions

- **Congested**: 1,400 vehicles / hour per lane or more
- **Maximum efficiency**: 1,000 - 1,400 vehicles / hour per lane
- **Room for additional vehicles**: Fewer than 1,000 vehicles / hour per lane
- **Ordinary roads**: 700 vehicles / hour per lane or more
- **Expressways**: 500 - 700 vehicles / hour per lane

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### Number of vehicles driving per lane per hour on ring roads in Tokyo metropolitan area, by time of day

- **Inner Circular Route**: 1,594 (Morning), 1,439 (Midday), 1,442 (Late Afternoon), 1,016 (Evening)
- **Central Circular Route**: 1,508 (Morning), 1,454 (Midday), 1,475 (Late Afternoon), 912 (Evening)
- **Tokyo Gaikan Ring Expressway**: 1,394 (Morning), 1,134 (Midday), 1,279 (Late Afternoon), 656 (Evening)
- **Metropolitan Inter-City Expressway**: 513 (Morning), 421 (Midday), 514 (Late Afternoon), 221 (Evening)
- **Ring Road No. 7**: 725 (Morning), 706 (Midday), 700 (Late Afternoon), 424 (Average speed)
- **Ring Road No. 8**: 539 (Morning), 515 (Midday), 523 (Late Afternoon), 403 (Average speed)

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### Smart Use of Expressway Network in Japan

- **Definition**: Congestion, maximum efficiency, room for additional vehicles
- **Average speed**: 7 a.m. - 6 p.m.
Incentives to drivers who select the best route in accordance with status of congestion is under consideration.

【Construction of ring expressway】

3 ring roads in central Tokyo 59% complete

82% (by 2015)

【Smart route selection using “ETC 2.0”】

Legend

Sectors that are in service (as of June 14, 2013)

To be in service by FY 2015

Under construction (to be completed in FY 2016 or thereafter)

Under study

※It is not known when non-completed lanes of provisional 2 lanes will be constructed.
Thank you!