ITS Advancement in Road Systems: Smartway

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1. Concept of Smartway

1) Overall image of ITS

Guidelines for the promotion of ITS:

- In October 2004, the ITS Strategy Committee issued a proposal on the areas in which ITS should actively contribute in the future.

(1) Safety and security
(2) Efficiency and the environment
(3) Convenience and comfort

Overall framework for the promotion of ITS:

- In July 1996, an overall framework for the promotion of ITS was formulated by four government agencies related to ITS.
- Since then, the promotion of research, development, and practical implementation has focused primarily on the following nine development areas of ITS in Japan.

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 in commercial vehicle operations
8. Support for pedestrians
9. Support for emergency vehicle operations
1. Concept of Smartway

2) Framework of Smartway
   (1) Smartway

Definition of Smartway

- Smartway refers to a road system that allows the exchange of various types of information among cars, drivers, pedestrians, and other users.

Foundation for the deployment of various ITS services

- Integrated realization of ITS to provide safe, smooth road transportation and a positive environment.

Foundation for affluence and comfort in life and society

- More efficient movement of people, goods, and information
- Realization of comfortable living spaces
- Building a national infrastructure that provides safety and peace of mind

Roads “Smartway”

ITS Communication

Vehicle “Smartcars”
1. Concept of Smartway

2) Framework of Smartway

(2) Smartway Project Advisory Committee

- Reversing the negative legacy of motorization
- Ensuring mobility for the elderly
- Developing affluent communities and lifestyles
- Improving the business climate

Providing a strong impetus for all areas of ITS

1. Advances in navigation systems
2. Electronic toll collection systems
3. Assistance for safe
4. Optimized traffic
5. Increasing efficiency
6. Support for public
7. Increasing efficiency in
8. Support for pedestrian
9. Support for emergency vehicle operations
2. Directions for Smartway policy

- **Advancement of car navigation system**
  - Support for autonomous mobility
  - Push-based info delivery
  - On-demand info provision

- **Advancement of car navigation map assistance**
  - TORUPA
  - Road Map for Comfortable Driving
  - App of CAD data for road construction

- **ETC**
  - Smart IC
  - Parking lot management

- **Promotion of safe driving assistance**
  - Prevention of Collisions with Obstacles
  - Support for merging
  - Support for demand bus

- **Promotion of road management efficiency**
  - Advancement of snowplow
  - Bus location system
  - Detection of icy road, snow forecast, rock fall detection

- **Support for public transportation/ Commercial vehicle operation**
  - Support for public transport
  - Promotion of road management efficiency with probe data

- **Support for road administrators**
  - Control assist
  - Support for driving

- **Support for safe driving**
  - Prevention of crossing collisions/ Prevention of right turn collisions

- **Support for road users**
  - Various info provision
  - Advanced traffic info provision

- **IT for vehicles and mobiles**
  - OBU/Mobile
  - DSRC
  - Cellular-Phone
  - ETC
  - VICS
  - W-LAN, Digital television

- **Timeline**
  - 1995
  - 2000
  - 2005
  - 2007
  - 2010
  - 2015
3. Advancement of car navigation systems

1) Spread of car navigation systems

- Reached 23 million units

Cumulative shipments of car navigation systems

- Number of licensed drivers in 2004
- Estimation of licensed drivers in 2030

Increasing senior drivers
- estimation of population and licensed drivers in 2030

Doubled

17 million
8 million

Safe for elderly

Visits to new sites
Sense of safe driving

Change in the driver’s sense of safety
- Result of questionnaire survey on the effect of car navigation
3. Advancement of car navigation systems

2) Spread of VICS

![Chart showing trend in the cumulative totals of VICS units shipped]

**Example of Display**

- Level 2: Simple Diagrams
- Level 3: Map Display
4. Advancement of ETC

1) Spread of ETC

Cumulative number of installed ETC on-board units

ETC utilization rate

- Cumulative total: About 14 million units (as of September 10)
- About 530,000 units per month (July)
- About 450,000 units per month (August)

- Trends in the use of ETC:
  - After nationwide deployment in December 2001
  - About 50,000 vehicles per day
  - Utilization rate: 0.9%

- Sep. 1-7, 2005
  - About 4.68 million per day
  - Utilization rate: 63.0%
4. Advancement of ETC

2) Effects of the spread of ETC

Fig.: Causes of congestion on expressways

- 31% of congestion is due to inadequate capacity at tollgates.

- Other 7%
- Margin lanes 22%
- Sags and Tunnels 40%

Fig.: Trends in ETC utilization rates and congestion at tollgates on the main lines of Metropolitan Expressways

- Amount of congestion (km h/day)
- ETC utilization rate (%)

- November 2002: 59.2 km/h, 4.8% utilization
- November 2003: 29.5 km/h, 14.5% utilization
- November 2004: 28.1 km/h, 7.9% utilization
- November 2005: 61.8 km/h, 3.2% utilization

Fig.: Change in carbon dioxide emissions at Yokohama-Machida Toll Plaza

- Reduced by 2,657 tons (52%) CO2 per year
- Calculated reduction in CO2 emissions due to ETC
4. Advancement of ETC

3) Field trials of smart interchanges

Smart IC field trial on National Highway 123

- Location
  Junction of the Joban Expressway with National Highway 123

- Time
  September 2006 - March 2007

Smart interchange at Kamisato Service Area

Smart interchange at Komazaki Parking Area
4. Advancement of ETC

4) Payment of public parking fees and private sector services

<table>
<thead>
<tr>
<th>OSAKA</th>
<th>NAGOYA</th>
<th>TOKYO</th>
</tr>
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<tbody>
<tr>
<td>Sakurabashi parking facility</td>
<td></td>
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<tr>
<td>• From December 1, 2005</td>
<td></td>
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<tr>
<td>• Payment of parking fees and guidance to handicapped spaces</td>
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</table>

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<tr>
<th>Ozone highway parking facility</th>
<th>Nishi-Shinjuku No. 4 parking facility</th>
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<tbody>
<tr>
<td>• From November 21, 2005</td>
<td></td>
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<tr>
<td>• Payment of parking fees</td>
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Other anticipated future uses

ETC will be used to simplify the procedures for vehicles boarding car ferries.

ETC will be used for payments at gas stations and drive-through establishments in order to improve convenience.

- Drive-through
- Gas station
5. Support for safe driving

1) Concept of safe driving support

**Lane Keeping System**
- Assists wheel control at a straight section of the road by keeping the vehicle inside the lane that is recognized by a camera.

- [Image of lane keeping system]

**Adaptive Cruise Control**
- Laser radar monitors ahead and maintains a certain speed. Also keeps a following distance when recognizing a preceding vehicle.

- [Image of adaptive cruise control]

**Concept of Safety System**
- Shifting the focus from passive safety to active safety
- When the detection from the onboard sensors is difficult or insufficient, information from the road infrastructure becomes necessary

- [Diagram showing cooperative safety system]

(Source: Honda Motor Co., Ltd. Official website)

(Source: Nissan Motor Co., Ltd. Official website)

(Source: ITS Japan)
5. Support for safe driving

2) Information Provision on forward obstacles

Fig. Field test site (No.4 of Metropolitan Expressway)
Source: AHSRA

Accidents covered by the service

- 79% reduction against previous fiscal year

Fig. Number of accidents during the field test
Source: AHSRA

Sensor detect traffic congestion, standing vehicles and slow-traveling vehicles

Infrared sensor

Approx. 300m

VICS Beacon

Simple diagram display of congestions at the start of curve

Car navigation Display

Fig. Was the information easy to understand?

Fig. Did the information work for safe driving?
5. Support for safe driving

- Multiple collisions occurred on the Chuo Expressway on September 14, 2006, causing several fatalities and injuries.
- There has been a high incidence of accidents at this location in the past as well.
- A service to provide information on obstacles in the road ahead will be deployed to reduce accidents in the future, primarily at this type of location.

- Gradual downhill gradient
- Sharp right-hand curve (R = 300 m)
- Raining at the time of the accident (1 mm/h)

Source: The Daily Yomiuri (September 15, 2006)

Source: Mainichi Shimbun, Internet edition (September 14, 2006)
5. Support for safe driving

3) New IT Reform Strategy

IT Strategic Headquarters
Director-General: Junichiro Koizumi, Prime Minister
Deputy Director-Generals: Shinzo Abe, Cabinet and 3
Members: Kazuo Kitagawa, Minister of Land, Infrastructure and others
Transport
Experts: Hiroyuki Itami, Professor, and 7 Hitotsubashi University others

IT New Reform Strategy

1. The Pursuit of IT Structural Reform Capabilities
   (1) Responding to Social Issues that Should Be Resolved in the Twenty-First Century
   (2) Realization of a Safe and Secure Society
      - The world’s safest road traffic environment
        - Reducing traffic fatalities to 5,000 or below -
   (3) Socio-Economic Activities in Twenty-First Century

2. Development of IT Infrastructure
   (1) The Realization of an IT Society without Digital Divide
   (2) Measures Designated to Create a Society in Which People Can Live Safely and Securely
   (3) Human Resource Development and Education
   (4) Research and Development

3. Provision of Valued Information to the World

Reduce the number of traffic fatalities and serious injuries by deploying Cooperative Safety Systems.

(January 19, 2006 decision by IT Strategic Headquarters)
5. Support for safe driving

4) “Road Maps for Comfortable driving” is being deployed to Car Navigation System

- Ordinary map
- "Road Maps for Comfortable Driving"
- 23 million car navigation systems with this feature have already been shipped.

- Priority route selection based on ease of use
  - Route selection
  - Easiest roads to use
  - Shortest time
  - Shortest distance
  - Avoid toll roads

- Providing information on difficulty of use
  - Narrow, winding road for the next 3 kilometers. Please drive carefully.
6. Realization of services

1) Public-private cooperation for platform development

<table>
<thead>
<tr>
<th>Date</th>
<th>Event/Action</th>
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<tr>
<td>DEC. 2004 - Jan. 2005</td>
<td>Public recruiting for joint research</td>
</tr>
<tr>
<td>Feb. 2005</td>
<td>Commencement of joint research</td>
</tr>
<tr>
<td>July 2005</td>
<td>Interim report</td>
</tr>
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<td>Feb. 2006</td>
<td>Smartway Demo 2006</td>
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<tr>
<td>Mar. 2006</td>
<td>Joint research report</td>
</tr>
<tr>
<td>Mar. 2007 (planned)</td>
<td>Specifications formulated</td>
</tr>
<tr>
<td>Oct. 2007 (planned)</td>
<td>Smartway 2007</td>
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</table>

6. Realization of services

2) Concept of the platform

- **Services to support safe driving**
- **New Applications**

**Common software**

**ITS on-board units**

**Common Hardware**
- Enhanced VICS beacons
- More sophisticated digital maps
- Fiber-optic networks, etc.

**Open platform**
6. Realization of services

3) Smartway Demo 2006

Dates: February 22 to 24, 2006
Place: Test Course at NILIM
DEMO events:
• Test Ride Demo
• Tour Demo
6. Realization of services

4) Smartway 2007

• The services planned for the Metropolitan Expressway in October 2007.
• When you travel to Beijing in 2007 for the next ITS World Congress, I hope that you will also stop in Japan and experience Smartway.