Arbetsrapport

R2003:015

ITS in Japan

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ITS in Japan

An overview of current activities

December 2003

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Lena Moritz

Enhetschef

Foreword

Japan is a densely populated country, where a high degree of centralisation, deep-rooted face-to-face business traditions, an appreciation for convenience and minute-fresh groceries, coupled with an apparent lack of urban planning and an under-dimensioned national road network, offers up an extraordinarily challenging transport situation. Still there are more than 70 million cars, and vehicles account for 60 % of the people and goods transported within the country.

Japan therefore has a long-standing interest and competence in ITS (intelligent transport systems), and the degree of deployment achieved is arguably unique:

- **Car navigation systems**: More than 12 million systems shipped.
- **Vehicle information and communication system** (VICS, transmits real-time information on traffic congestion and traffic regulations to car navigation systems): Over 7 million sold.
- **Electronic toll collection (ETC) system**s: A cumulative total of 1.5 million ETC in-car units installed

In fiscal 2002, car navigation systems were newly installed in 2.42 million vehicles, over 86% of which were also equipped with VICS units.

It is this impressive base of onboard units (OBUs) and road-based information supply system that the ITS related industry and authorities in Japan now want to use for the next step of ITS evolution: two-way communication not only for toll collection and route information, but for any car and transport related information, payments, authentication, traffic and security systems, in-car services and entertainment.

(Continued on next page.)

FIGURE 1. THE PRINCIPLE OF THE DSRC SYSTEM

The base will be DSCR, the active 5.8 GHz Dedicated Short Range Communication system which was adopted in Japan for road-to-vehicle communication of the ETC (Electronic Toll Collection System), also called a transceiver system. It is two-way interactive, so both on-board and roadside devices transmit and receive signals equally.

The active system enables larger volumes (up to 4 Mbps) of information to be communicated faster and with higher reliability than the passive method, in which on-board devices are not equipped with transmitters. Communications is possible between the roadside antennas and both stationary and fast-moving vehicles, and can be applied to various ITS services.

Several trials, for example Smartway, Smart Town and Smart Parking, are being performed around the country by public organisations and private industry to evaluate the possibilities and develop new services. In parallel, a common platform is being developed. By 2005 the actors hope that the first DSRC based applications will be in service.

This report offers an overview of some of the areas which Japanese ITS related R&D focuses on, and some of the on-going activities.

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Tokyo 2003-12-17
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Innehåll

1 Public organisations

1.1 ITS Japan

Fore more info, please see:

http://www.iijnet.or.jp/vertis/e-frame.html
http://www.iijnet.or.jp/vertis/e-strategy.pdf

1.1.1 Organisation and activities

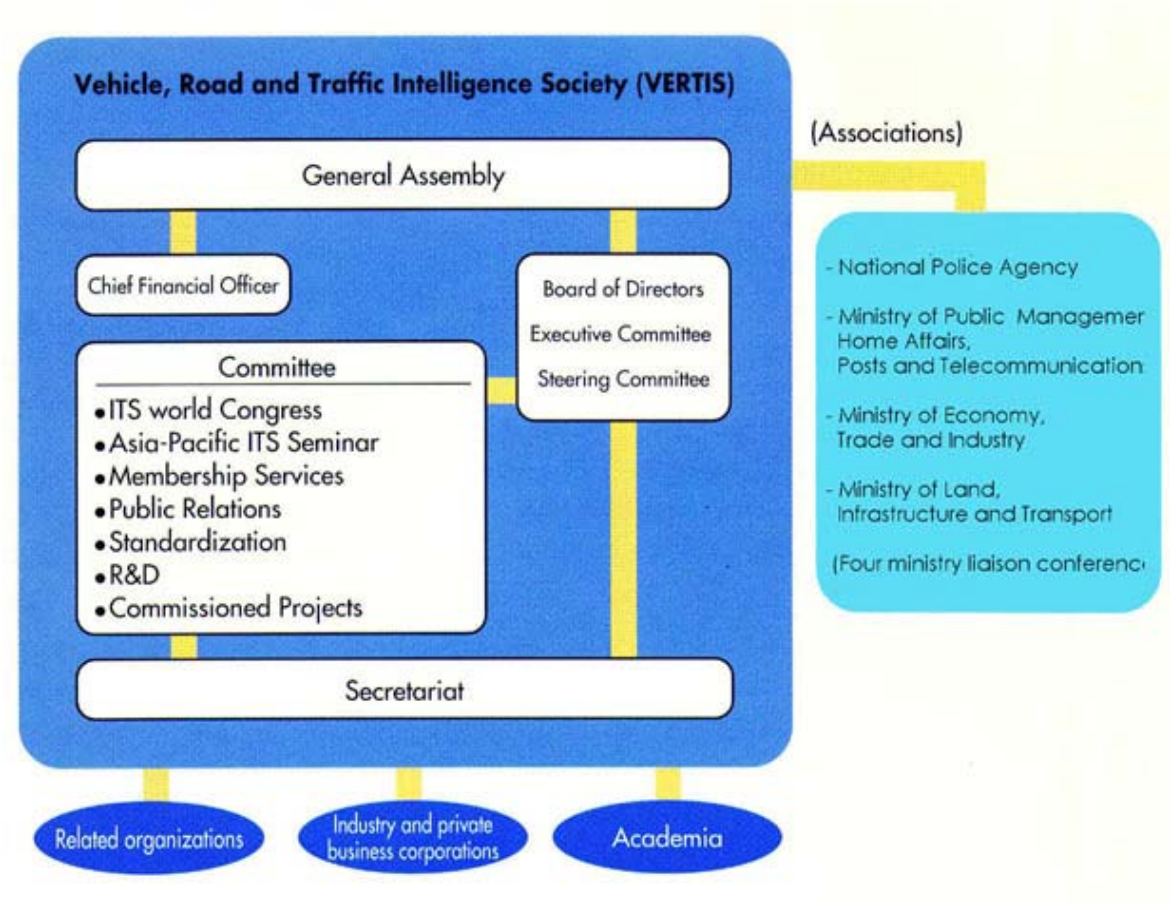
"ITS Japan" is the Japanese counterpart of ERTICO (a Europe-wide, not-for-profit, public/private partnership for the implementation of Intelligent Transport Systems and Services[1]) and ITS America[2]. It was established under the name of The Vehicle, Road and Traffic Intelligence Society (VERTIS) in 1994 with support by the National Police Agency, the Ministry of Posts and Telecommunications, the Ministry of Economy, Trade and Industry, and the Ministry of Land, Infrastructure and Transport. VERTIS was renamed to "ITS Japan" in June 2001.

ITS Japan is the contact window in Japan to the ITS related industries and academia from Japanese ministries as well as foreign organizations. It consists of representatives from ITS-related organizations, industry and private business corporations as well as academia. Working together with the four government ministries and agencies related to ITS, ITS Japan works for an early and wide deployment of ITS, mainly through the following activities:

- Promoting ITS R&D and deployment
- ITS World Congress Asia-Pacific area contact
- Asia-Pacific ITS Forum Secretariat
- Liaison among ITS-related public and private organizations and academia
- Supporting ITS-related standardization activities

[1] *http://www.ertico.com/index.htm*
[2] *http://www.itsa.org/new.nsf/vHomePage/$first!OpenDocument*

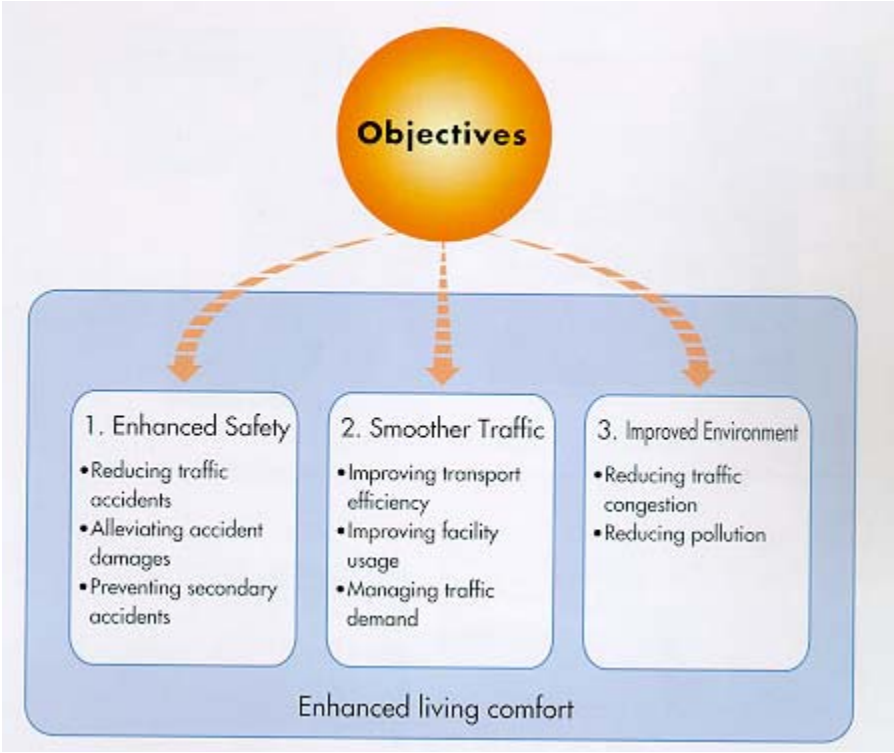
FIGURE 2: ORGANISATION OF ITS JAPAN, PREVIOUSLY VERTIS



1.1.2 Objectives

ITS Japan works to realise the vision that around 2010, state-of-the-art technology in positioning and data communications will be applied to ITS in order to link people, roads and vehicles in a network, thereby enabling improved road usage, high-efficiency transport and comfortable road travel.

FIGURE 3: OBJECTIVES OF ITS JAPAN



The expected advantages of ITS are divided into three categories: safety and security; efficiency and environmental preservation; and convenience and comfort, and ITS Japan have formulated their objectives as follows.

(1) In safety and security, ITS Japan aims first to achieve, in a model space, a zone where traffic accident fatalities are reduced to zero. This accomplishment is then to be deployed nationwide, contributing to a 50% reduction of total traffic accident fatalities on all roads by 2010.

(2) In terms of convenience and comfort, ITS Japan aims to upgrade the public infrastructure to create a comfortable transportation environment, to provide cities and spaces where transportation is an enjoyable and convenient experience, for pedestrians, drivers and users of public transport alike.

(3) As a target for efficiency and environmental preservation, ITS Japan aims to provide a zone of zero traffic congestion. Achieving this objective is expected to contribute to reducing CO_2 emissions by road transport vehicles to the government's target of 1995 levels by 2010.

1.1.3 Plans and proposals

Safety and security

Creating a Model Zone of Zero Traffic Fatalities

In its bid to halve the number of traffic fatalities in Japan by 2010, Japan has designated several areas where such deaths are especially frequent for transformation into areas of zero traffic fatalities. In these ITS promotion zones, various measures will be tackled in collaboration with local governments and road-management authorities to assure safe passage for both vehicles and pedestrians, thereby dramatically reducing the incidence of traffic fatalities within the model zone.

Role of private-sector operators

Private-sector operators will obtain from the National Police Agency data on areas in which traffic accidents are especially common. These operators will then draft ITS proposals and submit them to local governments, selecting and proposing areas of high traffic fatality rates to transform into zones where traffic fatalities are reduced to zero using ITS. The operators will then move to achieve zero traffic fatalities within those ITS model zones.

Role of ITS Japan

ITS Japan will serve as the central liaison body for the overall ITS effort, setting up contact meetings among industry, government and academia. In the overall project for zones of zero traffic fatalities through ITS, ITS Japan tables the overall proposal and oversees its execution.

Liaison among industry, government and academia

(a) Research and development of the component technologies used in the project will be carried out through liaison among industry, government and academia. (b) This liaison process will establish and implement nationwide the methods used to evaluate the ITS promotion zones.

Role of ministries and agencies

(a) Ministries and agencies will construct infrastructure, creating a communication environment linking roads, vehicles and pedestrians.

(b) These bodies will also introduce the systems that support safe, smooth transportation through harmonization of infrastructure and vehicles.

(c) Ministries and agencies will offer the necessary deregulation.

Promoting Global Harmonization Toward Greater Traffic Safety

All of the world's developed nations have taken their own initiatives to reduce traffic accidents, with each country approaching the problem according to its own unique set of circumstances. Nonetheless some features of traffic accidents, and the

measures taken to reduce them, are similar around the world. It makes sense for authorities in each nation to share information about these approaches and to bring effective new approaches rapidly to market. To promote both collaboration and competition in finding lasting solutions, ITS Japan recommends the following international cooperative activities.

1) Safety forums can be jointly formed by Europe, the US and Japan at the ITS World Congress.

2) These forums can serve as an opportunity to enlighten the general public about traffic safety technology and to demonstrate the safety technologies developed in Europe, the US and Japan.

Convenience and comfort

Creating a Model Zone of Comfort in Transportation

Focusing on transportation for individuals, the government is examining the creation of intermodal transportation zones as a form of Human navigation for the handicapped and non-handicapped alike. These intermodal zones will provide citizens with a wide range of information that will enable them to travel with comfort and convenience.

Role of private-sector operators

(a) Capitalizing on the ITS technology assets accumulated in car-mounted navigations systems, navigational support systems for pedestrians will be developed, enabling people to determine their current positions and the directions they need to take, quickly and accurately. Such systems may be incorporated in camera-equipped mobile phones, PDAs or the like.

b) Close cooperation and liaison will be maintained with the Internet ITS consortium.

Role of the public sector

Initial setup of public infrastructure

Nationwide Deployment of "Smart Towns" (short-term)

ITS Japan has proposed the spread and development of Smart Towns, as presented at the 11th World Congress on ITS, Nagoya - Aichi, 2004, in every part of the nation, according to the unique characteristics of each region. This can be compared to the US initiative where ITS America is promoting a program called Rural ITS, an ITS system rooted in the climate, culture and ways of life of rural communities. In Europe a version of ITS is being promoted that emphasizes regional character to promote tourism.

In Japan, transfer of financial resources from the national government to the regions is investigated, with the aim of offering each region the interdependence to propose its own plans and appropriate the necessary budgets.

Promoting Multipurpose Use of ETC (short-term)

ITS Japan proposes to expand the business opportunities offered by the broad customer base of ETC systems to find new business applications for ETC and the development of DSRC applications in a number of fields.

Role of private enterprise for ETC

Provision of vehicle-mounted units as a set with car navigation systems; examination of DSRC businesses that an expanded ETC base would make possible

Role of the public sector for ETC

(a) Effective use of public infrastructure, such as raising the efficiency of expressway sections

(b) Establishment of dedicated ETC facilities (such as gates and interchanges)
(c) Measures to eliminate congestion at toll booths where ETC alone cannot provide a full solution

Roles of private enterprises for DSRC

(a) Promotion of development of DSRC applications

(b) Development and manufacture of low-cost roadside systems

Roles of the public sector for DSCR

(a) Release of security codes for security access modules (SAMs) and related fee settlement systems

(b) Further promotion of joint chip development

Provision of Traffic Congestion Information

Transport management systems, traffic volume surveys and the like present new business opportunities. Other opportunities exist in supplementing the partial traffic-report information gathered by services such as VICS, for example services providing government agencies with probe data on road traffic in real time and provision of local traffic volume surveying packages (equipment, personnel, etc.)

Role of private enterprise

(a) Spread of logistical management systems

(b) Development of terminal technologies and devices that can be selected to avert communication of personal information

(c) Expansion of terminal sales, assuming existence of plans to build out low-cost infrastructure for DSRC

(d) Application of features made available through Internet-based ITS projects

Role of the public sector

(a) Establishment of a system for purchase of road-traffic probe reports using PFI
(b) Publication of the cost-benefit advantages of the policy using probe data

(c) Establishment of a system to train the private sector in processing and editing traffic data

(d) Widespread installation of short-range communication facilities specialized for automobile use

(e) Presentation of DSRC infrastructure building plans, assuming realization of general services based on DSRC applications

Environment and efficiency

The problem of urban traffic congestion has a grave impact in terms of both economic loss and environmental damage (through the emission of carbon dioxide).

A wide range of measures are under consideration to reduce traffic congestion, including:

- Building more advanced traffic control systems and traffic signals
- Normalization of traffic demand by informing drivers of traffic congestion
- Maximization of the transportation efficiency of road (introducing new concepts of cost, incorporating environmental factors)
  Driving costs (road pricing)
  Parking costs (on-road and off-road)
- Increase in freight handling efficiency
- Enhancement of intermodal solutions such as park-and-ride facilities

Tokyo and Japan's major cities face numerous traffic problems associated with mechanisms for the transport of goods. The transport of freight occupies an important place in Japan's transportation landscape. Accordingly, a significant portion of the "New Comprehensive Program of Logistics Policies" promoted by the Japanese government deals with improvements such as measures to prevent entry of freight-carrying vehicles into city centres and efforts to improve logistical systems. ITS Japan has examined a number of specific measures in which ITS can be used to achieve efficient and effective transport of goods.

Improvement of the efficiency in transporting goods

(a) Reduced occupancy of roads for door-to-door collection and delivery, transport to and from convenience stores, etc., to eliminate traffic congestion caused by transport vehicles

(b) Support of advanced IT for transport contractors, especially partial release of advanced traffic management systems for use by small and medium-sized operators

(c) Stronger management of shipment of hazardous materials

Automated cruising of transport tracks and vehicles in dedicated road zones

(d) To eliminate traffic congestion, the productivity of roads is to be maximized, to obtain maximum effectiveness of this important community asset.

(e) Given the rising average age of drivers in the transport industry, the work environment for people driving at night will be improved.

(f) Transport costs can be reduced to boost the international competitiveness of the Japanese economy.
(g) Major improvements in the safety of automated driving and automated cruising can be used to reduce the attention load on drivers.

Role of private-sector operators

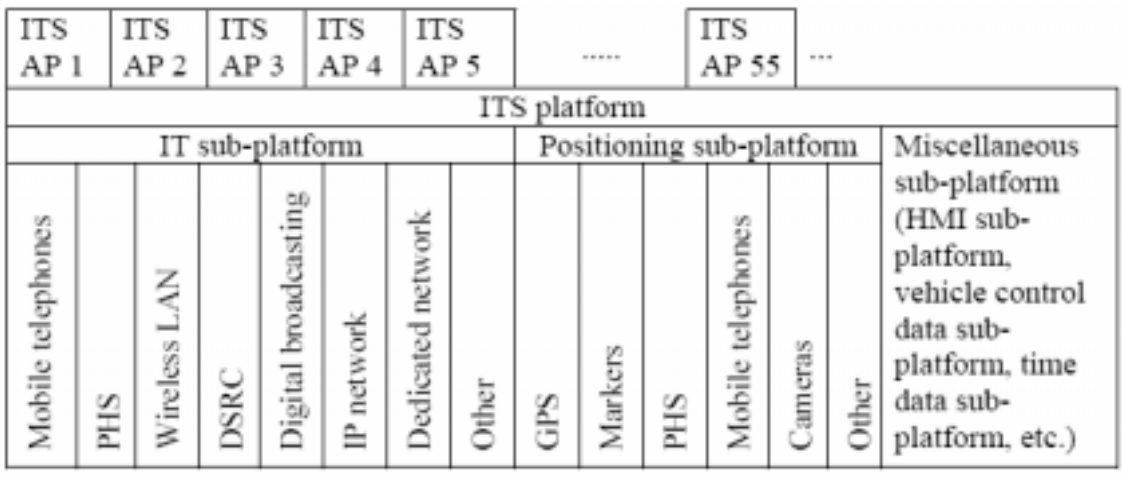
(a) Development and commercialization of ITS technologies to optimize parking, load management etc. of transport vehicles
(b) Deployment and expansion of parking-facility systems in transport-vehicle load management
(c) Development and marketing of technologies for automated driving systems

Role of the public sector

(a) Upgrading of public infrastructure
(b) Partial release of public traffic-management system functions for the use of the private sector Common platform

In addition, ITS Japan promotes the establishment of a comprehensive ITS platform, on which to base the in total 55 services which they have identified. Of these 50 meet ITS user needs and five are for cargo transport.

FIGURE 4: ITS PLATFORM SUGGESTED BY ITS JAPAN



More information about these plans can be found in ITS Japan's strategy document from July 2003, http://www.iijnet.or.jp/vertis/e-strategy.pdf.

1.2 The government: ITS in Japanese policies

For more information, see http://www.kantei.go.jp/foreign/policy/it/index_e.html,

1.2.1 Overview

There are currently 4 ministries which directly work with ITS[3]:

- The National Police Agency (NPA)
- The Ministry of Public Management, Home Affairs, Posts and Telecommunications (MPHPT)
- The Ministry of Economy, Trade and Industry (METI)
- The Ministry of Land, Infrastructure and Transport (MLIT)[4]

FIGURE 5: ITS RELATED WEB SITES FOR GOVERNMENTAL BODIES

[3] *These ministries were formed after the reformation of Japanese governmental body in January 2001. MPHPT was formerly the Ministry of Posts and Telecommunications, METI was formerly the Ministry of International Trade and Industry, and MLIT was formerly the Ministry of Transport and the Ministry of Construction*

[4] *See also http://www.its.go.jp/ITS/*

We have looked especially at how ITS appears in the Japanese IT policy, which relates to all ministries. In the e-Japan Strategy II, which was released this summer, the following policy objective appeared:

> While continuing to expand the existing Intelligent Transport System (ITS) particularly focusing on road system infrastructure, a transportation system will be established with the world's most advanced network environment by implementing Internet ITS. This will provide a highly effective information environment for drivers and passengers.
>
> The Internet utilization environment for automobiles, trains, aircrafts, etc., will be improved.

1.2.2 Objectives

Below is a summary of the ITS related objectives, including responsible ministry and deadline, as they appear in the policy programs related to the e-Japan Strategy II.

Promotion of a system to shorten emergency response times (NPA by FY 2005)

Fast Emergency Vehicle Pre-emption System (FAST): FAST reduces the time required for emergency vehicles to reach accident sites, enabling them to act promptly, and to prevent secondary traffic accidents involving emergency vehicles through preferential signal control and by indicating the most appropriate routes.

Realization of Internet ITS (MPTHPT and METI by FY 2005)

Integrate ITS related information organically, use advanced high-speed radio network, and realize high-speed Internet for ITS. To realize that, technologies needed for retrieval and distribution of various kinds of large capacity information from automobile cruising at high speed should be put into practical use under the collaboration among industry, government, and academia.

Promote R&D on Internet ITS Platform, which connects running automobiles with the Internet in the optimal way by utilizing multiple media efficiently according to their location and application.

Enhancement of road traffic information provision (MPA, MPHPT, and MLIT by FY 2005)

In order to promote high value-added information provision services by private sectors, build-up a database of traffic regulations information needed for car navigation system and other systems.

Optical beacons which can communicate with automobiles will be set up on major roads in cities by FY 2005.

Promotion of driving support systems and safe driving support systems (NPA, MPHPT, and MLIT by FY 2005)

Promote R&D on technologies for driving support system, such as, information provision to drivers, danger alert to drivers, and operation support. Realize such

technologies in around 2003. Safety drive support system with optical beacons is to put into a practical use by FY2005.

Promotion of Electronic Toll Collection (ETC) (MLIT by the end of FY 2007)

By FY2003, all the toll gates of the toll roads should be equipped with ETC, and dedicated ETC lanes.

Promotion and dissemination of services applying Dedicated Short Range Communication (DSRC) (MPHPT, METI, and MLIT in FY 2003)

Promote DSRC system for multi-purpose use. By the end of FY2003, establish a regional ITS information communication model system, and based on the system, promote the use of such DSRC systems.

Promotion of Integrated Traffic Control Systems (ITCS) (NPA by FY 2005)

By FY2005, MODERATO (advanced traffic control system, which enables adaptive control of traffic signals dynamically according to environment data) and real-time traffic signal control system are to be developed.

Promotion of the international standardization of Intelligent Transport System technology (NPA, MPHPT, METI, and MLIT for the next three years)

Driving support system and DSRC based system will be put into suggestion to ISO and ITU as international standards.

Enhancement of measures for popularizing Intelligent Transport Systems (NPA, MPHPT, METI, and MLIT in 2005)

Provision of real-time position information for public buses by NPA and MLIT around 2005

Around 2005, real-time bus location information system will be provided at bus stops.

Introduction of Public Transportation Priority systems (NPA and MLIT around 2005)

By around FY 2005, PTPS (Public Transportation Priority Systems) and MOCS (Mobile Operation Control Systems) will be introduced major cities nationwide.

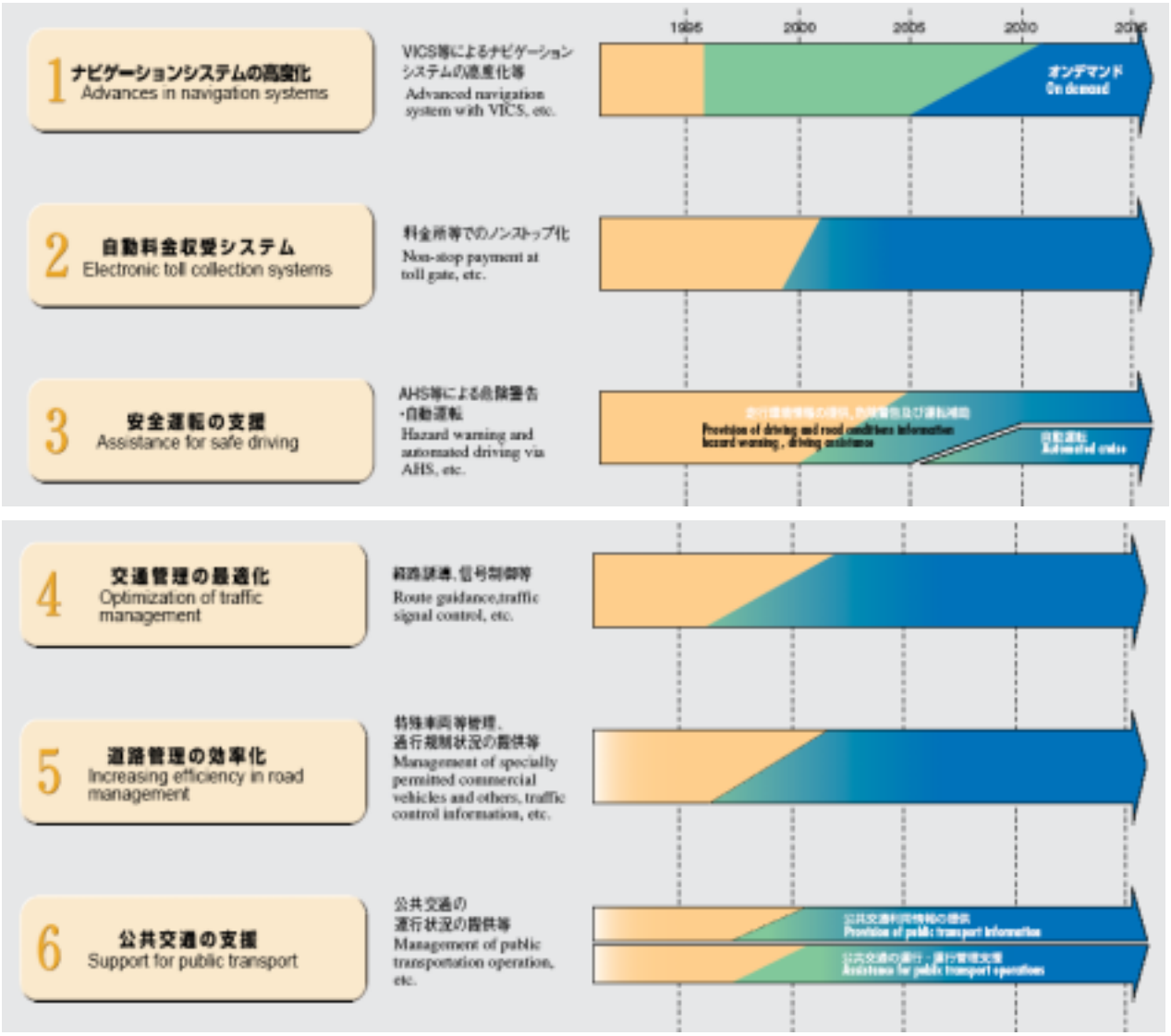
PTPS support the operation of large-volume public transportation systems with the aim of increasing convenience through safe and smooth operation. This is made possible by traffic signal systems that give priority to buses and exclude other vehicles from bus lanes.

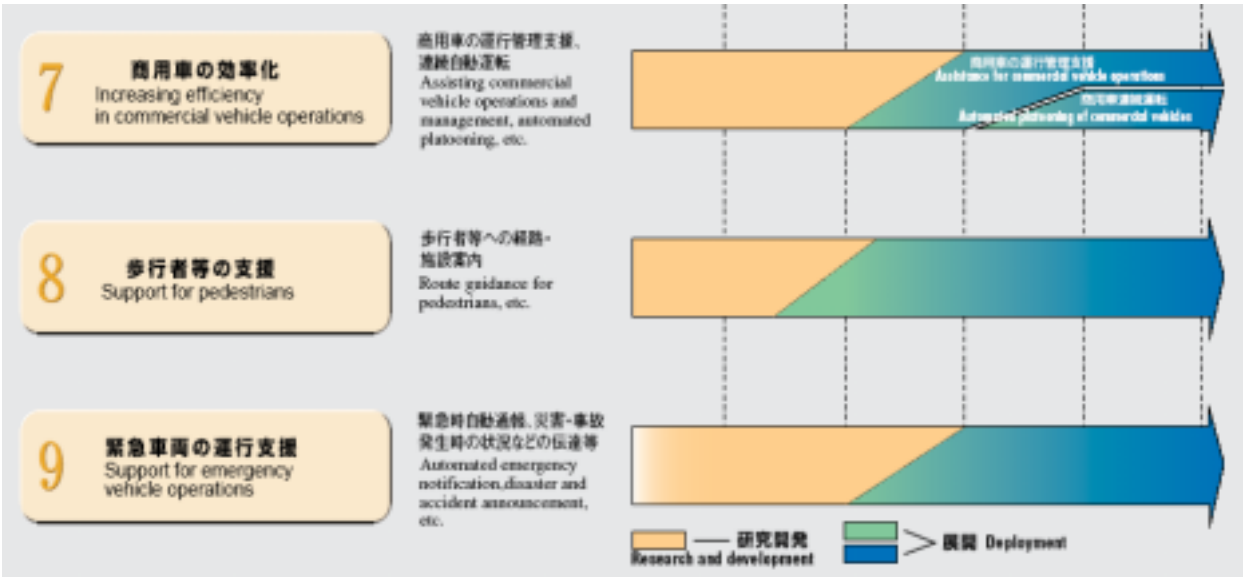
MOCS help companies operating bus, truck, and taxi transportation to accurately determine their operating situation so that they can effectively control operation of their vehicles.

2 Activities

2.1 Overview

Already in 1996, the (then) five ITS related ministries compiled a "Comprehensive Plan for ITS in Japan" which defined 9 areas of user services, development and implementation:





Below are some examples of activities and visions for these areas, commonly shared by the industry and the authorities.

2.2 Navigation System and Telematics Services

Vision: Traffic information is distributed in real-time to the driver via an in-car navigation system. The in-car unit is compatible with on-demand functions and information supply units along the road, so that the best route and the traffic flow is directed in the optimum way. The traffic information includes traffic congestion information for each optional route, required time to the destination, traffic restriction information, and current information on parking availability. The information is also distributed to homes and offices to assist drivers in deciding on an efficient travel plan prior to departure. In addition, service information including the destination's regional information is distributed on demand via the in- vehicle equipment, the parking/service areas along expressways, and the "Michi-no-Eki" (the roadside stations) along ordinary roads.	 - Provision of route guidance traffic information - Provision of destination-related information

Status

Japan has long been leading in the implementation of car navigation systems in passenger cars. The market encompasses more than 70 million vehicles, and vehicles account for 60 % of the people and goods transported within this country. Both car makers and electronics makers have recognized the large market potential and developed it skillfully. Now the dissemination of car-navigation systems in Japan is the highest in the world; currently the cumulative total of car-navigation systems that has been shipped in this country exceeds 12 million. In addition, VICS units (Vehicle Information and Communication System), which receive real-time information on traffic congestion and traffic regulations to car navigation systems, have been installed in over 7 million vehicles. In fiscal 2002, car navigation systems were newly installed in 2.42 million vehicles, equivalent to 24% of the households, and over 86% of these systems are also equipped with units enabling them to receive (almost) real-time traffic information from the Vehicle Information and Communication System (VICS[5]) Centre over radio, and to show it on the display of car navigation system.

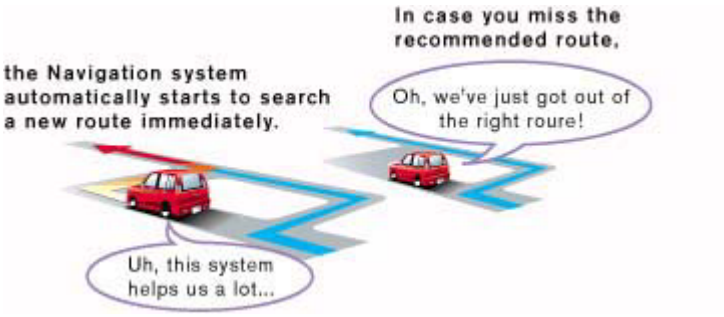
FIGURE 6. NUMBER OF INSTALLED VICS AND CAR NAVIGATION SYSTEMS

[5] *The Japanese government began installing VICS (vehicle information and communication system) infrastructure in the mid-1990s, allowing drivers to access and view traffic and routing information on their systems via FM multiplex broadcast (approx 50 Kbytes/5 mins per station), radio beacons (approx 8 Kbytes per beacon), and infrared beacons (approx 10 Kbytes per beacon).*

Below is an except from a brochure presenting a typical car navigation system.

FIGURE 7: EXAMPLE OF FUNCTIONS OFFERED BY STANDARD CAR NAVIGATION SYSTEM

<table>
<tr><td colspan="2">DVD NAVIGATION SYSTEM
(N'FIT Xanavi)
English menu / voice assistance</td></tr>
<tr><td colspan="2"> 
</td></tr>
<tr><td>Easy operation with
English menu.
 
</td><td>The remote control and menu displays in English. User-friendly menu allows you to easily access frequently used functions. *Location names on the map are in Japanese.</td></tr>
<tr><td>Instant search of your destination
by phone number.
 
</td><td>Input any phone number in the NTT town page. Having a database of 11million numbers, your destination and most convenient route will be displayed on the screen.</td></tr>
<tr><td>Junction View keeps you
on track at road junctions.
 
</td><td>The navigator displays are always shown in real time, easy-to-read and reliable. There is no need to worry about driving at complicated expressway junctions.</td></tr>
</table>

A zoom display helps to guide you through complicated intersections. 	At intersections with multiple lanes, you can switch between normal and symbolized map screen displays. You are warned when approaching junctions with unmarked lanes This enables you to drive confidently on unfamiliar roads.
English voice guide will let you drive effortlessly without need of looking at the screen. 	The English voice guide helps you to make turns at intersections and to identify expressway junctions and exits along the route to your destination. You can concentrate on the road and drive safely without needing to look at the screen.
If you make a wrong turn, the auto-reroute function will get you back on track. 	If you detour from your route, the voice guide will help you return to the correct road. With the navigator's quick automatic search function, there is no need to worry about getting lost,

All this forms the base for a new market, that of telematics services. The basic use of VICS enabled car navigation systems is limited to receiving and displaying information about road congestion information and approximate travel time to the destination, layered on the route navigation map. However, already in 1997 there were some first generation interactive paid-services provided via cell phone network to registered users by carmakers and car navigation manufacturers. The added functions were like collecting information from the Internet with car navigation system instead of PC. For example, weather report, restaurants/parking areas/tourist spots information, and still pictures of some road spots were stored in special data servers, and users could retrieve and see them on car navigation systems.

Also, users could access directly to the Internet, surf real web-sites, and send/receive e-mail. They were read out for drivers with synthesized voice, for safety reason.

When a user chose a tourist spot as the destination, the location information was set in the car navigation system, and the route and estimated travel time were displayed on the digital map.

The first generation of added services were run by joint ventures of carmakers, car navigation manufacturers, and related companies like digital map suppliers. The services were:

- Toyota group's[6] *MONET*
- Honda's *INTERNAVI*
- Nissan group's[7] *COMPASS LINK*
- MAZDA's *MAZDA Telematics*
- DYMLER JAPAN's *ITGS*
- SONY/PIONEER/IBM group's[8] *MOBILE LINK*

Users can receive location information directly to their car navigation. Only Nissan's COMPASS LINK adopts human operators to answer requests from users via mobile phone with hands free operation.

As technologies have advanced, new interactive services have been developed for consumers. Since 2002 car manufacturers and navigation-system vendors have initiated strategic approaches to expand with second-generation interactive services to expand usage from in-car to home, town, and convenience shops, combining the car navigation system with communication unit or cell phone, PC, PDA, and Internet enabled cell phone.

Mobile phone entered 3G era, and it boosted the data transmission speed faster. Thanks to the price reduction and also newly developed higher capacity memory devices, the storage media for car navigation systems have changed from CD-ROM to DVD, Hard Disk, and memory cards. Also as the penetration of PC, PDA, and Internet enabled mobile phones among consumers have increased, such tools have been used together with car navigation systems in a wide variety of life scenes.

For example, before departing travel by car, users can access to the Internet by PC at home, and make a route plan by choosing interesting travel spots, together with travelling companions. Then, they can send the route plan to their car navigation system by e-mail. Duding the travel, the driver or passenger can talk to an operator at a call centre, and ask for advice for restaurants according to their preferences, and receive the location information of the chosen restaurant to the car navigation system, which is added as a new destination to the route plan for guiding the route. While a driver is looking for a parking place, passengers can do shopping, and receive their car location information with a map to their mobile phones by e-mail. Teenagers may want to listen to newly released pop music again, when they happen

[6] *Toyota, Aisin, Denso, Matsushita Communications, Fujitsu Ten*

[7] *Nissan, Zanavy, Clarion, and Calsonic*

[8] *Sony, Pioneer, Dentsu, IBM, Increment-P, Watanabe Digital Media, and Zenrin*

to hear one on FM in the car at mid-night. They may be able to buy one by down-loading to a memory card at a multimedia KIOSK terminal in a convenience shop, and place it to the car navigation system to play back. When busy business people receive urgent e-mail from their secretaries during vacation, the e-mail could be read out by synthesized voice while driving, and they could call in hands-free.

However, due to the high development cost both on hardware and software for the new services, some first generation services will be shutting down, and alliances and tie-ups have announced. In fall 2002, Toyota Motor Corporation started interactive services under the name of "G-Book", which can provide users with the above-mentioned services. It uses CDMA-2000 1x (3G mobile phone technology) packet data transmission at 144 kbps at maximum, and most probably extends to higher rate with CDMA2000 1x EV-DO at 2.4 Mbps maximum, 600 kbps in average, to handle moving picture contents.

The service is a vehicular version of the mobile internet service i-mode. Its functions include downloading of music and games, and e-shopping. Toyota recognizes that for it to be able to expand the service, it should be inexpensive, and so the company's charging plan is a low flat rate of 6,600 yen (60 US$) per year. Toyota is also negotiating with four of its competitors regarding the inclusion of its G-B00K terminals on the other manufacturers' vehicle. Already Daihatsu Motor, SUBARU (Fuji Heavy Industry), and Mitsubishi Motor announced to join, and MAZDA seems to be in the final process to accept.

Honda Motor, Japan's second-biggest manufacturer of cars, is offering an interactive route-information service, Inter-Nave Premium, for its automobiles. An alliance between Nissan and Suzuki Motor "Carwings" have been providing similar services. The uniqueness of InterNavi Premium by Honda is to provide users with its own traffic information, carefully selected to offer true value to the driver. The information is based on statistics and data collected via VICS since October 2002. These include detailed traffic information and car-maintenance information that is provided in response to vehicle location/condition information automatically transmitted from the vehicle via its communications system. Also, InterNavi Premium Club members transmit their own car location and travel time information to its centre, and the information is collected, processed, and distributed to the members, which also increases the accuracy of estimated travel time of each club member.

Regarding Nissan's Carwings service, it is still offering the COMPUS LINK's human operator service as a main feature among other similar services, which helps especially people who do not like to or are not able to handle the complex terminals.

Below is a summary of the telematics services currently offered.

FIGURE 8: MAIN TELEMATICS SERVICES

Service Provider	Service Name	Data Launched	Features and Strategy	Communications Link	Current Trend
Toyota	G-BOOK	October 2002	- Vehicle version of i-mode - Multimedia-oriented approach - Aggressive formation of alliance with other auto manufacturers	CDMA2000 1x	
Honda	Inter-Navi Premium Club	February 2002	- Concentrating on services for comfortable driving	Mobile network	Plan to incorporate telematics products in 30 % of cars and sold in 2003
Nissan	Car Wings	October 2002	- Aiming for fast penetration of the market with inexpensive products	Mobile network	Suspend existing service in 2005
Mitsubishi	IT Dion	Under trial	- Plan to utilize vehicles as "hotspots" (IEEE802.11b) - Investigating commercial-use specifications in the trial	Inside vehicle: IEEE802.11b Outside vehicle: DSRC, PHS	Remote control of various vehicle functions, including upload of car-condition information
Mazda	Mazda Telematics	April 2002	- Strategy to include the products at standard options	Mobile networks	
Pioneer	Air Navi	October 2002	- To include full communications capability with vehicle-navigation products	CDMA 2000 1x module included	
Clarion	AutoPC CADIAS	December 2002	- Vehicle mounted PC adopting MS Windows Automotive	Mobile network	

(Source: nG Japan, November 24, 2003)

It is clear that every auto manufacturer is keen to introduce telematics in order to improve the company's new car sales. The automobile market is already saturated and the number of new cars being sold has been declining. Consequently, car manufactures are putting more stress on customer retention, i.e., an automaker's introduction or promotion of telematics often is done as a CRM technique to deepen the company's relationship with those owners.

See for example

- http://panasonic.biz/its/ctlg/pdf/P9_10.pdf or
- http://www.hitachi.co.jp/Prod/tsji/its/eng/global/n_on-board_e.html (for info from equipment makers)
- http://www.iijnet.or.jp/vertis/its-products/e-its-products/e-c-c.html (for other makers of ITS systems)

2.3 Electronic Toll Collection

Vision: Electronic toll collection is enabled without stopping at the tollgate, which eliminates traffic congestion, improves driver convenience by cashless payment, and reduces administrative costs. The ETC system will be able handle tolls in different according to the type of vehicle and distance travelled. Furthermore, the same on-board equipment (OBE) can be used on toll roads managed by different administrative bodies.	 - Electronic toll collection

Status

When ETC was developed, the following was agreed:

1) Specifications to be unified to make the system available to users nationwide and compatible for transactions on all toll roads in Japan;

2) a 5.8GHz-band active system to be adopted as a DSRC (Dedicated Short Range Communication) system to ensure precise interactive communication between the vehicles and roadway units;

3) the "two-piece" method using an OBE and an IC card to be adopted, to cope with future functional development and to allow multipurpose use of IC cards; and

4) IC cards with built-in OBE such as a CPU to be used, targeting to allow mutual verification with other terminal equipment and coding of recorded data for high security.

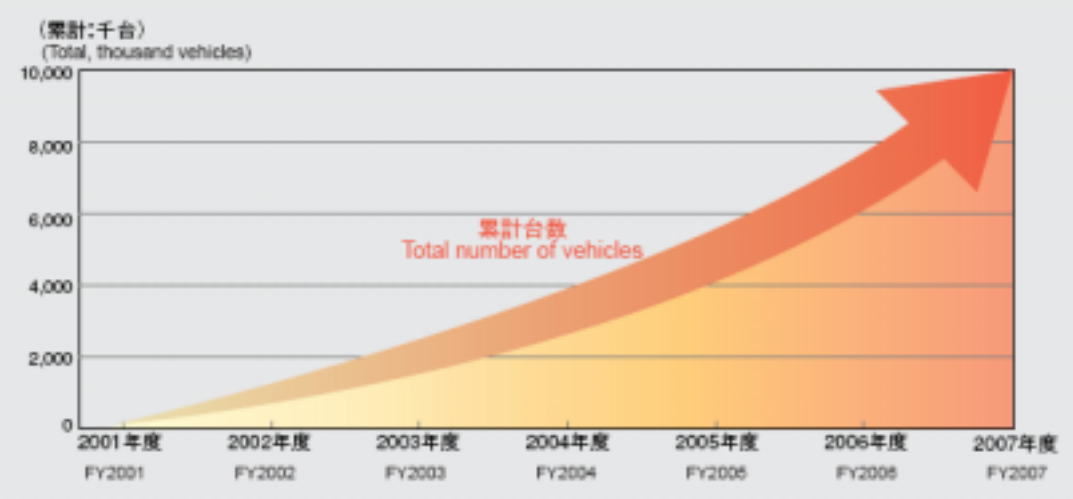
FIGURE 9: DIFFERENT TYPES OF IN-CAR ETC SYSTEMS

ETC, which started service in March 2001, had been installed at 882 highway toll gates by the end of September 2003, and will be installed at all gates by the end of fiscal year 2003. Currently more dedicated ETC lanes are created, and specific ETC discounts are created.

The equipment makers quickly saw the business opportunities, and the car makers started pre-installing ETC systems as a competitive advantage. By end October 2003, ETC on-board equipment had been installed in over 1.75 million cars, with 740 000 vehicles using them daily accounting for 11.5% of all vehicles that use toll expressways. On the Tokyo Metropolitan Expressway, 13.6% of vehicles use ETC.

Meanwhile the price of on-board devices has fallen from ¥30,000 - ¥50,000 to under ¥10,000 (about 700 SEK), and the government estimates that the penetration should reach 70% by the end of fiscal 2007.

FIGURE 10: NUMBERS OF CARS SOLD WITH PRE-INSTALLED ETC SYSTEMS



For more information, see for example

- http://www.its.go.jp/ITS/2003HBook/p38-43.pdf (for overview information
- http://panasonic.biz/its/ctlg/pdf/P3_4.pdf or
- http://www.hitachi.co.jp/Prod/tsji/its/eng/total/n_etc_e.html (for technical information from suppliers)

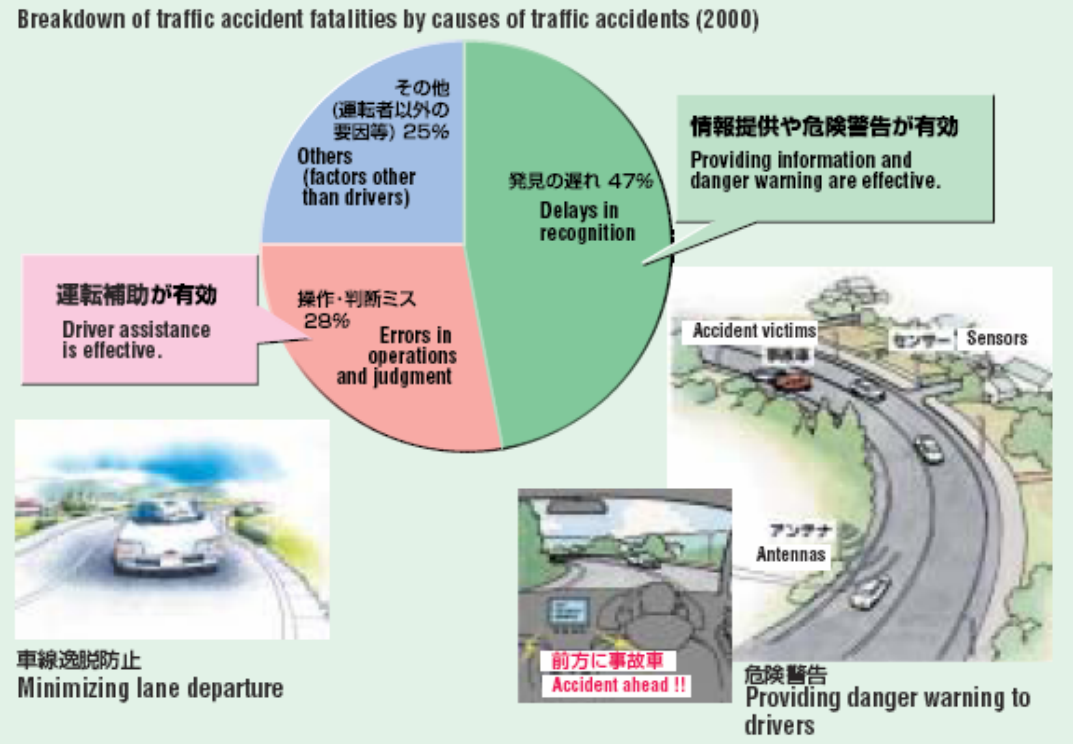
2.4 Safe Driving

Vision: To prevent traffic accidents, various types of sensors are used on the road and in the vehicles to collect driving conditions data including the ambient road and vehicle situation. The in-vehicle equipment and road information system are used to provide driving conditions information and possible warnings to each driver in real time. An automatic control function is added to the vehicles to support the driver's operation through speed control by automatic break operation or driving assistance by steering wheel control if danger. The system should take into account the position and behaviour of the control vehicle and surrounding vehicles, and obstacles. In addition, automatic vehicle driving is implemented with ambient driving environment sensing and advanced driver assistance functions. The latter includes speed control through automatic brake and accelerator operation and steering wheel control.	 - Provision of driving and road condition information - Danger warning - Assistance for driving - Automated highway systems - Advanced Cruise-assist Highway system

Status

Japan is currently evaluating AHS (Advanced Cruise-Assist Highway Systems). The aim purpose is to provide drivers with information, warnings, and operational support to eliminate 1) delays in recognition, 2) errors in judgment, and 3) errors in operation, which are the three major causes of accidents. The systems consist of 1) roadside sensors, which detect obstacles such as standing vehicles, slow vehicles, and rear-end congestion, and transmit the information to vehicles, and 2) on-vehicle systems that transmit the information to drivers by voice and head-up displays (images projected on the front glass) depending on the speed of the vehicle. AHS effectively prevent accidents through cooperation between the roadside and in-vehicle units and providing information to drivers in real time.

FIGURE 11: CAUSES OF TRAFFIC ACCIDENTS, 2000



As the first step for deployment of AHS, the causes of traffic accidents were analyzed, and the seven service domains most requested by the public were selected, namely:

1) Support for prevention of collisions with forward obstacles;

2) Support for prevention of overshooting on curve;

3) Support for prevention of lane departure;

4) Support for prevention of crossing collisions;

5) Support for prevention of right turn collisions;

6) Support for prevention of collisions with pedestrians crossing streets; and
7) Support for road surface condition information.

In October 2000, joint tests started in Tsukuba, Ibaraki Prefecture, with a system combining AHS with Advanced Safety Vehicle (ASV). For four days from November 28, 2000, a demonstration "Demo 2000" was held to showcase the results.

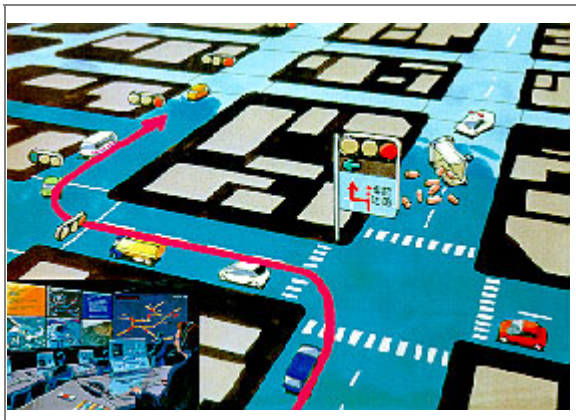
In September 2001, a proving test system was constructed based on the developed technologies and AHS-ASV cooperation. From fiscal 2002, proving tests 2002 are being conducted to examine the effectiveness of the systems, their convenience for drivers, and the validity of infrastructure system design values.

The decision to go ahead with AHS will be decided based on cost effectiveness, acceptability by the public, and dissemination.

For more info, see for example

- http://www.its.go.jp/ITS/2003HBook/p44-49.pdf (more applications examples)
- http://panasonic.biz/its/ctlg/pdf/P7_8.pdf or
- http://www.hitachi.co.jp/Prod/tsji/its/eng/total/n_ahs_e.html (system suppliers)
- http://www.jari.or.jp/en/hokoku/jido/ji0308_e.html (JARI, Japan Automobile Research Institute, one the research institutes that looks into driving safety)
- http://www.ahsra.or.jp (AHSRA, Advanced Cruise-Assist Highway System Research Association)

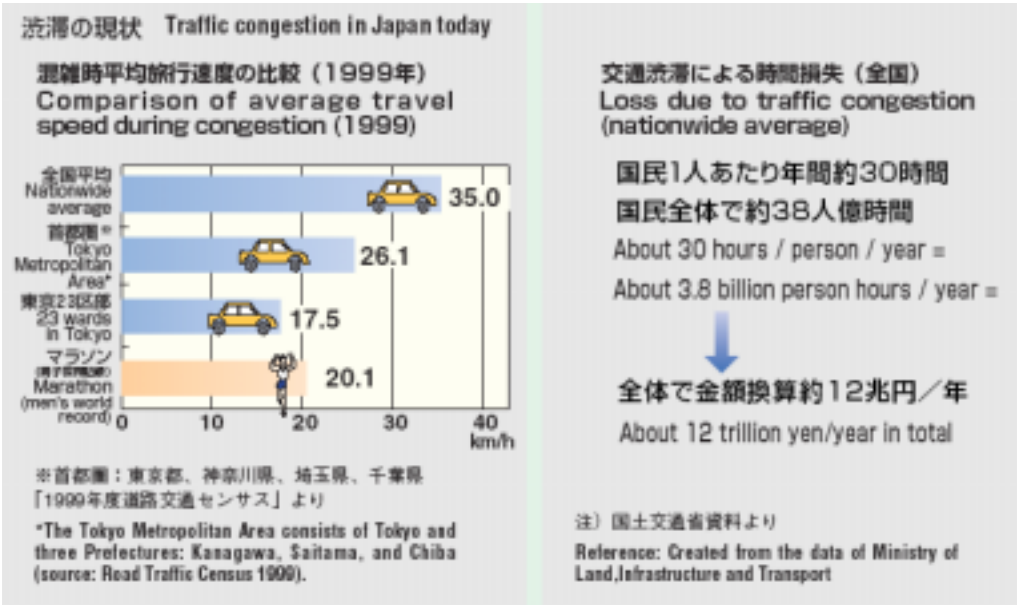
2.5 Traffic Management

Vision: To improve traffic safety, driving amenities, and the road environment, optimum signal control is implemented for the entire road network as well as for areas with exceptional traffic congestion and damaged roadside environments. Mobile navigation is performed for the driver using in-vehicle equipment and information supply units to administer the traffic. To minimize spread and impact of traffic accidents, it should be detected quickly, traffic control performed, and traffic restriction information distributed to the drivers through the in-vehicle equipment and information supply units.	 - Optimization of traffic flow - Provision of traffic restriction information on incident management.

Status

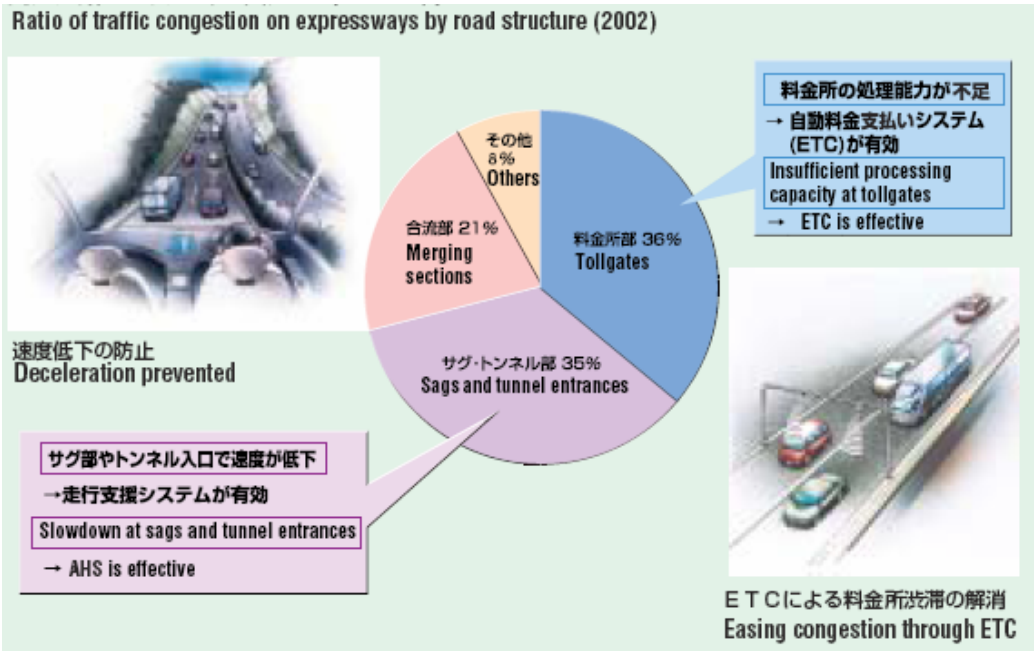
Japan is a densely populated country, and congestion of the transportation systems is a daily annoyance which is costing the society and the individual large amounts every year.

FIGURE 12: SOME INFORMATION ABOUT JAPAN'S CONGESTION PROBLEM



All prefectures in Japan have to varying degrees introduced Traffic Control Systems as part of a Universal Traffic Management Systems (UTMS). Through for example infrared beacons, information about the traffic is collected and analysed at centres around the country. Real-time traffic information is provided to a number of subsystems. One example is the Advanced Mobile Information System, which provides real-time traffic information to the drivers. Traffic information gathered at the Traffic Control Centre is fed to in-vehicle car navigation systems or provided via traffic information display boards, car radios, and other-media.

FIGURE 13: REASONS FOR CONGESTION, 2002



For more information on what systems are currently in use in Japan, and where, see http://www.utms.or.jp/english/index.html.

2.6 Road Management

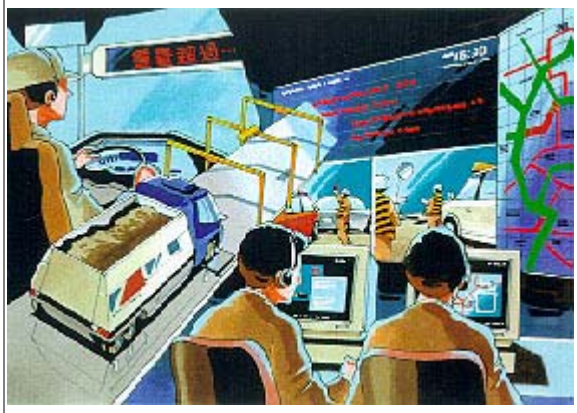
Vision

In connection with road work, timing, planning and directions to the vehicles are supported by information on road surface conditions and work vehicle positions.

In case of a disaster, damage to the road facilities and surrounding areas are identified, and proper road administration is executed through efficient arrangement of road recovery vehicles and the establishment of a rapid recovery system.

Special vehicles are properly managed by using an electronic application and transaction processing; generating a database of transport permitted routes, identifying the actual transport routes of the permitted vehicles, and automatically identifying the load weight of passing vehicles with the vehicle weight scale.

In addition, information related to weather conditions and transport restrictions are quickly distributed to the drivers through the in-vehicle equipment and information supply units to maintain safe and smooth traffic flow in accordance with the natural conditions in each region.



- Improvement of maintenance operations
- Management of special permitted commercial vehicles
- Provision of roadway hazard information

Example: Road Control Centre

The Shikoku Regional Development Bureau established Shikoku Block Road Information Control Center to univocally control 1) the registration and updating of traffic regulation information for roads in the area (disasters, prior traffic regulations, construction works, etc.), and 2) the monitoring and operation of various information collecting systems, 24 hours a day, to correctly and rapidly control and utilize road information.

The Centre not only collects information on national highways, which are under direct control of the Ministry of Land, Infrastructure and Transport, but cooperates with public road corporations in the area, Honshu-Shikoku Bridge Authority, the governments of Tokushima, Kagawa, Ehime, and Kochi Prefectures, police, and fire-fighting stations to collect wide ranges of information and to increase the efficiency in road management.

The establishment of the Shikoku Block Road Information Control Centre enables univocal collection of real-time road information, integrated operation of road information boards, univocal control of information provision history, integrated information provision levels in offices, and collection of information of roads in a large area.

The Centre is also providing road users with real-time information through the Internet website, mobile phones with Internet access, VICS, and other information provision devices.

[Sikoku Regional Development Bureau, Ministry of Land, Infrastructure and Transport]

Example: rock fall detections system

The Honzon-iwa area in Niigata Prefecture often experiences rocks falling from the steep cliffs. A rock-fall detection system was adopted to reducing traffic disturbances and increase security. The system detects rocks hitting the fence of the protection net on the slope. Information such as "Caution! Rocks falling" and "Road closed because of falling rocks" can be given early to car drivers, and help with detour routes.

After the system was adopted no instances of serious traffic disturbance was detected during 5,5 years (June, 1995 to February, 2001), in an area that previously had up to 14 such instances in one single month.

The time lost due to necessary detours was reduced to 30 minutes compared to 4 hours before the system was introduced.

[Niigata National Highway Office of Hokuriku Regional Development Bureau, Ministry of Land, Infrastructure and Transport]

Example: Tunnel deformation system

National Highway No.112 ("Gassan Road") is prone to landside damage, and has been patrolled to prevent serious accidents. To supplement such control systems, the Sakata River and National Highway Office of the Ministry of Land, Infrastructure and Transport is developing a road management system that uses optical fibre strain gauges to monitor deformations of road structure. Sensors have been installed on Asahi No.1 and No.2 Tunnels along National Highway No.112 ("Gassan Road") and are used for monitoring strain. Optical fibre strain gauges, which are attracting attention as a new measuring and monitoring technology for large areas, are characterized by 1) continuous real-time monitoring, 2)the ease of remote control, 3) linear and two-dimensional monitoring, and 4) durability.

Studies are being conducted to effectively utilize new road monitoring technologies, such as optical fiber strain gauges, to supplement patrolling.

[Sakata River and National Highway Office of Tohoku Regional Development Bureau, Ministry of Land, Infrastructure and Transport]

Example: Snow removal

In the eastern area of Tottori, one of the areas in Japan with heavy snowfall, effective snow clearing is necessary to ensure smooth and safe traffic conditions. Relevant information is nowadays available directly to the snow-clearing vehicles' GPS units through internet and CATV. These provide information on accurate location, speed and condition of the job, which has decreased start-up time and the need for interaction between the drivers and the dispatching centre.

[Tottori River and National Highway Office of Chugoku Regional Development Bureau, Ministry of Land, Infrastructure and Transport]

2.7 Public Transport

Vision: Support is given to flexibly choose mode of transport, transfer and departure time. All information, including the operating state, seat occupancy state, required fares and fees, as well as parking availability of the public transport facilities, is distributed to implement optimum usage of transport facilities. The information is transmitted to terminal units at homes, offices, in-vehicle equipment and portable terminal units, and to information supply units installed in the roads, terminals, bus stops, and expressway service areas. In addition, to improve convenience with safe and smooth operation of the public transport facilities and efficiency of the business administration, the operation and administration of the public transport facilities are supported by real-time collection of the operating status of the public transport facilities, performing priority dispatch as necessary, and distributing the collected information to the public transport companies as basic data.	 - Provision of public transport information - Assistance for public transport operations and operations management

Example: Bus location system

To ease traffic congestion and offer information to the passengers about such things as present location of bus, time table, predicted arrival time, occupancy, etc, several areas in Japan are implementing systems that supply information over the internet and mobile phones.

Kyusyu IT's bus provides such information on 3 routes of highway buses operated between Fukuoka and Oita. According to a survey, about 40% of the respondents base their decision of transport mode in the information the can get in that way.

The number of passengers per day is about 1,700, with the average frequency of access to the system 179, and a maximum of 1,547 accesses/day. The frequency of access increases in bad weather.

[Fukuoka and Oita National Highway Office of Kyusyu Regional Development Bureau, Ministry of Land, Infrastructure and Transport]

For example of the type of information provided, see http://road.qsr.mlit.go.jp/-itsbus/select1.phtml

For more information, see for example http://www.its.go.jp/ITS/2003HBook/-p61.pdf.

2.8 Commercial Vehicles Operations

Vision
To improve transport efficiency and safety, as well as reduce the volume of commercial traffic, operation is supported by real-time collection of operation status of trucks and tourist buses, which is then distributed to the transport operators.
Efficiency of logistics is supported by establishing automated, systematized logistics centres, shared delivery, and distributing return tag information.

- Assistance for commercial vehicle operations management
- Automated platooning of commercial vehicles

For information, see for example http://www.its.go.jp/ITS/2003HBook/p62-65.pdf

2.9 Pedestrian support

Vision
To form a safe and pleasant road environment that pedestrians and people without vehicles, including elderly and handicapped, can use securely, information and route guidance is offered through portable terminal units, magnetic media and voice.
The green light signals are also distributed to portable terminal units so that pedestrians can safely cross the road.
In addition, to avoid accidents, the driver is warned when pedestrians are in the vehicle's path, and/or the brakes are automatically activated.

- Pedestrian route guidance
- Vehicle-pedestrian accident avoidance

See http://www.its.go.jp/ITS/2003HBook/p66-67.pdf for some examples of applications.

2.10 Emergency Vehicle Operations

Vision

To implement rapid and proper recovery and rescue activities following a disaster or accident, the vehicle involved automatically notifies the organizations concerned with an emergency message to greatly reduce time for recognizing the disaster or accident and identifying the location.

In addition, information about the traffic and road damage conditions are collected in real time and transferred to the organizations concerned to perform rapid routing of recovery vehicles to the site.

- Automatic emergency notification
- Route guidance for emergency vehicles and support for relief activities

3 Links

Below are links to ITS related organisations, some of which have appeared in the text above.

Please note that several IT related organisations provide relevant news over e-mail. Registration is possible at http://www.jice.or.jp/itslist-e/

ITS Japan
ITS Japan
http://www.its-jp.net/

学識経験者・企業・関係団体で1994年組織され、ＩＴＳ関係四省庁(国土交通省、警察庁、郵政省、経済産業省)と連携し、ＩＴＳの早期実用化の推進に取り組んでいます。
2001年6月にVERTISからITS Japanに改称しました。
VERTIS: Founded in 1994 by experts and academics, private companies and other related parties. It is now involved in promoting early ITS deployment, in collaboration with four related parties: the Ministry of Land, Infrastructure and Transport, National Police Agency, Ministry of Public Management, Home Affairs, Posts and Telecommunications, Ministry of Economy, Trade and Industry. The name VERTIS was changed to ITS Japan in June 2001.

技術研究組合 走行支援道路システム開発機構(AHSRA)
Advanced Cruise-Assist Highway System Research Association(AHSRA)
http://www.ahsra.or.jp/

民間企業21社が連携して1996年に設立。走行支援道路システム(AHS: Advanced Cruise-Assist Highway Systems)の研究開発を目的とする団体です。
AHSRA: Jointly founded in 1996 by 21 private companies for research and development of the Advanced Cruise-Assist Highway systems.

財団法人 道路交通情報通信システムセンター(VICSセンター)
Vehicle Information and Communication System Center (VICS Center)
http://www.vics.or.jp/

1995年設立され、ＶＩＣＳ(Vehicle Information and Communication System)による道路交通情報の提供と、ＶＩＣＳの全国展開に取り組んでいます。
VICS Center: Founded in 1995 for promoting the provision of road traffic information by the Vehicle Information and Communication System (VICS), and nationwide VICS deployment.

財団法人 国土技術研究センター(JICE)
Japan Institute of Construction Engineering(JICE)
http://www.jice.or.jp/

1973年設立され、建設技術に関するさまざまな調査や研究開発に取り組んでいる、総合的な調査研究機関です。1998年にITS企画推進室が設置されています。
JICE: Founded in 1973 as a comprehensive organization to undertake research and development of various construction technologies. The ITS promotion group was established within the organization in 1998.

財団法人 道路システム高度化推進機構(ORSE)
Organization for Road System Enhancement
http://www.orse.or.jp/

1999年設立され、ＥＴＣ(Electronic Toll Collection System)のセキュリティ規格と識別処理情報を提供し、ＥＴＣの普及促進や調査研究に取り組んでいます。
ORSE: Founded in 1999 as an organization to promote the ETC (Electronic Toll Collection) System, undertake research and development of related technologies, and provide security standard and identification information for ETC users.

財団法人 道路新産業開発機構(HIDO)
Highway Industry Development Organization(HIDO)
http://www.hido.or.jp/ITS/

1984年設立され、道路に関する新しい分野での研究開発から国際標準化・広報活動にいたるまでの幅広い活動を実施し、「新しい道づくり」を目指しています。
HIDO: Founded in 1984 as an organization for helping establish new road systems by conducting various activities such as research and development on new road-related technologies, international standardization, and public relations.

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