TECHNISCHE
UNIVERSITÄT
DARMSTADT

Fachgebiet
Verkehrsplanung
und Verkehrstechnik

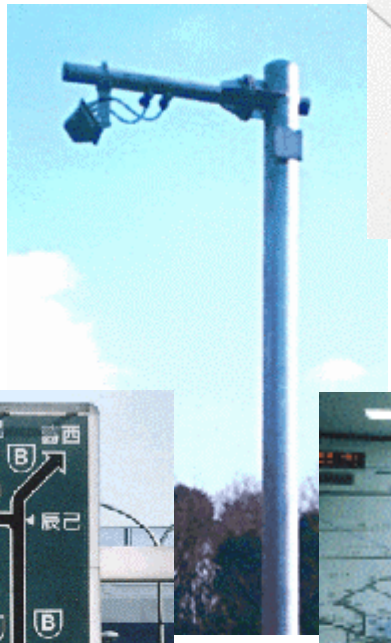
Intelligent Transport Systems in Japan

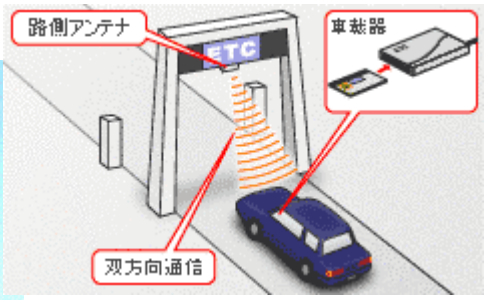
Saskia Hollborn

Intelligent Transport Systems (ITS)

in Japan

OKI 2002





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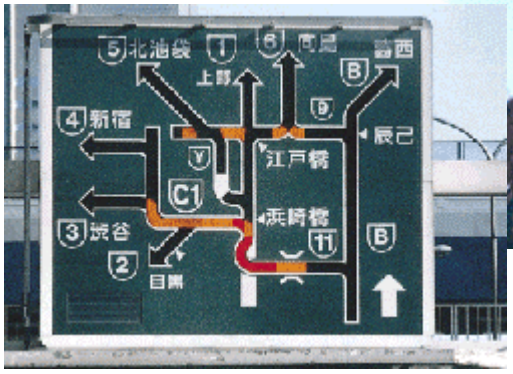

MEX 2001

HIDO 2001

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Tokyo, July 2002

Acknowledgments

This report was written during my stay at Kuwahara Lab., Institute of Industrial Science, University of Tokyo from June 16th, 2002 to August 7th, 2002.

I would like to acknowledge the following people whose support and assistance have been invaluable to me during these days in Japan and in writing this report: First and foremost, Prof. Kuwahara. Thanks to Mr. Sakamoto from Sumitomo Electric, Mr. Koshimoto from VICS Center, Mr. Warita from Metropolitan Expressway Public Corporation and Mr. Schmidt-Clausen from VOLKSWAGEN Group Japan KK. And my special thanks to all people from the Metropolitan Police Department, Mr. Yamazah, Mr. Takizama and Mr. Iryo from Kuwahara Lab. for the translations.

Finally I would like to acknowledge the opportunity given to me by Prof. Dr.-Ing. Boltze, the Rhein-Main-Verkehrsverbund (RMV), Prof. Kuwahara and my parents to spend two months at Tokyo University. I also would like to thank Ms. Morimoto for helping me to find an accommodation.

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1 Preface

Compared to other industrialized countries in the world Japan has built-up a considerable lead in the application of advanced communication and information technologies to decrease one of its most obstinate problems – traffic congestion.

HISAKAZU [HIDO 2001] says, that congestions in various parts of the country due to the increase in vehicle traffic cause a time loss of 5.3 billion hours annually, which corresponds to an economic loss of JPY 12 trillion. Additionally almost 10,000 people are killed in traffic accidents annually. Vehicle traffic causes considerable harm to the environment [IWASAKI 1997]

Many countries all over the world directed their attention to move people from point A to point B more efficiently and safely. Specially Europe as well as the USA have spent millions of dollars for research, but it is in Japan where the commercial application of "Intelligent Transportation Systems" (ITS) technologies is established. ITS is the general term used for new road transport systems driven by advanced information and communications technology.

Japan's congested roadways and general concern for the environment are the principle reasons why these technologies are promoted. ITS is expected to help resolve these problems by eliminating the amount of time people are wasting in traffic jams and producing exhaust gases.

There are nine areas of ITS under development, aiming at the reduction of traffic accidents, the realization of automatic driving, the relief of traffic congestion and the improvement of the environment. It is said that by 2015, ITS will create a market reaching 50 to 60 trillion yen [MLIT 2002]. A wide range of industries, including the automobile, electronics, finance and construction industries are developing products and services driven by ITS, as well as the development of new infrastructures.

These are the nine areas of ITS which are developed in Japan [MLIT 2002; ITS JAPAN 2002]:

1. Advances in Navigation Systems
2. Electronic Toll Collection
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
8. Support for Pedestrians
9. Support for Emergency Operations

The following **tables 1** and **2** show the link between the development areas, the user services and their specifications:

User Services	**Development Areas**	**Viewpoints for User Service Specification**		
		Main Users	**Needs**	**Conditions**
(1) Provision of route guidance/ traffic information	1. Advances in navigation systems	Drivers	To obtain traffic information from navigation systems	Travel from departure points to destinations
(2) Provision of destination-related information				Selecting and obtaining information on destination
(3) Electronic toll collection	2.Electronic toll collection systems	Drivers, carriers, and management agencies	Automatic toll exchange without stopping	(Toll) payment at toll gates
(4) Provision of driving and road conditions information	3.Assistance for safe driving	Drivers	Safe driving	Recognition of traffic conditions
(5) Danger warning				Recognition of hazardous conditions
(6) Assistance for driving				Operation to avoid hazardous conditions
(7) Automated highway systems				Automated driving
(8) Optimization of traffic flow	4.Optimization of traffic management	Drivers and management agencies	Optimization of traffic flow	Traffic management
(9) Provision of traffic restriction information on incident management			Adequate measures against traffic accidents	

Table 1: Framework of ITS User Services [MLIT 2002]

User Services	Development Areas	Viewpoints for User Service Specification		
		Main Users	**Needs**	**Conditions**
(10) Improvement of maintenance operations	5.Increasing efficiency in road management	Management agencies	Prompt and adequate management of road maintenance	Road management
(11) Management of special permitted commercial vehicles		Drivers, carriers, and management agencies	Prompt and adequate issuance of permits for special vehicle passage	
(12) Provision of roadway hazard information		Drivers and management agencies	Adequate response to natural disasters, etc.	
(13) Provision of public transport information	6.Support for public transport	Public transport passengers	Optimal use of different transport modes	Use of public transport
(14) Assistance for public transport operations and operations management		Carriers and public transport passengers	More convenient public transport, more efficient management and safer transport	Implementation of traffic operation management and priority control
(15) Assistance for commercial vehicle operations management	7.Increasing efficiency in commercial vehicle operations	Carriers	Efficient collection and delivery, and safer transport	Implementation of commercial vehicle operations management
(16) Automated platooning of commercial vehicles			More efficient transport	
(17) Pedestrian route guidance	8.Support for pedestrians	Pedestrians and cyclists	More convenient travel	Moving on foot, by bicycle, etc. Travel by walking, etc.
(18) Vehicle-pedestrian accident avoidance			Safer travel	
(19) Automatic emergency notification	9.Support for emergency vehicle operations	Drivers	Request for prompt and accurate rescue	Request for emergency relief
(20) Route guidance for emergency vehicles and support for relief activities		Drivers	Prompt and adequate route guidance to disaster sites	Restoration and relief activities

Table 2: Framework of ITS User Services [MILT 2002]

The following paper is focused on three of the major ITS areas: the advances in navigation systems, electronic toll collection systems and traffic and road management. Other major ITS areas are not surveyed in this study.

Some of these nine areas, like the support for pedestrians, the increasing efficiency in commercial vehicle operations or the assistance for safe driving are still in a status of research and development. Up till now only the focused ITS areas have already been introduced and deployed.

2 Effects of ITS and ITS activities

2.1 Roles of ITS

“An ITS car information system is an information processing system that is installed in a vehicle for providing various types of information services to the driver through the exchange of information between inside and outside the vehicle via telecommunication and broadcasting” [HITACHI 2000].

If one talks about ITS in Japan, ITS is understood as an integrated system of each specifically developed system such as VICS (Vehicle Information and Communication System), ETC (Electronic Toll Collection) AHS (Advanced Highway System), UTMS (Universal Transportation Management System) or multi modal transportation.

ITS are pushed forward by four Japanese Government ministries (the National Police Agency, the Ministry of International Trade and Industry, the Ministry of Posts and Telecommunications , the Ministry of Transport and Construction), and academic and private companies whose focus is on developing major ITS systems.

The four governmental bodies have set up an inter-ministerial council and work together in mutual cooperation. The Vehicle, Road and Traffic Intelligence Society (ITS Japan formerly VERTIS) is the academic and industrial organization for ITS advancement. ITS Japan works together with the governmental bodies. This society is also engaged in international technology and information transfer.

JAMA (1999) says that ITS technologies “will have an annual market value of about $500 billion (60 trillion yen) at current exchange rates by the end of 2015, the experts contend. They also predict that the Japanese will save another $25 billion (3 trillion yen) each year just by eliminating traffic jams and accidents. Furthermore, fuel consumption will drop by 15 percent over the next 30 years, and exhaust emissions will fall by 30 percent in urban areas if ITS becomes universally used, the experts predict”.

2.2 ITS Activities

The most popular product in a growing list of commercially available ITS technologies is the satellite-based on-board navigational system. It guides users around even minor roads using location information provided by a network of earth-orbiting satellites operated by the U.S. Defense Department. However, these dashboard-mounted devices are just one of many technologies that Japanese planners and consumers have started to embrace as a way of promoting safety and conservation.

Undoubtedly, satellite-based navigational systems are one of the ITS building blocks. One of its applications can be found in the so-called Vehicular Information Communication System (VICS), which uses FM radio wavelengths or a beacon to transmit up-to-the-minute traffic information to anyone with an on-board navigational device. With this service, motorists can see the traffic tie-ups on their system monitors and can choose the least-congested routes.

Another important ITS application is the automatic money collection system for the use on toll roads. Once Electronic Toll Collection (ETC) systems are installed, drivers do not have to stop at tollgates to pay cash any longer. An antenna affixed to each tollgate communicates with automobiles equipped with an electronic card and automatically deduct the fee from the driver's prepaid account. According to statistics, five times as many cars can go through ETC-equipped tollbooths.

Taking advantage of the ITS promise, the Japanese Government is planning to build a "Smart Highway" or an intelligent road that uses cutting-edge ITS technology to help drivers to judge traffic conditions. Standards have been set by 2001. The first application of such a concept may be the 2nd Tokyo-Nagoya-Kobe Highway, which is expected partially to open in 2003.

In addition to the “Smart Highway” the development of a “Smart Car” is also forced in Japan. In the future vehicles will do far more than they do today. New sensing systems are developed that sound an alert when it detects a motorist falling asleep behind the wheel. The technology is based on the use of an infrared beam, a low light-level camera and image-recognition software to monitor a driver's eyes and blink rate. Other technologies include the use of radar and Charge-Coupled Detector (CCD) cameras to help vehicles remain in their own lanes.

At last, the optimization of traffic management is built up. Traffic management includes the

controlling of traffic signals depending on traffic volume by improving control centers and centralizing traffic signal controls. But other services like the provision of traffic information or the information service have to be mentioned as well.

2.3 Development of ITS

First Phase (around 1995)

The beginning of ITS can be estimated approximately in 1995. At that time leading systems including the Navigation System were introduced. This period is also called the initial stage of ITS. Since 1996, traffic information and similar systems have started to be in service.

In addition, traffic congestion information and best routes are displayed on the in-vehicle navigation system so that the driver can manage pleasant travel including travel time reduction.

This first phase is also characterized by the introduction of electronic toll collection to reduce traffic congestion at the tollgates.

Second Phase (around 2005)

THE MINISTRY OF LAND, INFRASTRUCTURE AND TRANSPORT (MLIT) (2002) says that in this second phase “information distributed to the users by ITS will include service information and public transport information about the destination, which will have enhanced content to further improve the user services. For example, when a trip is being planned, a destination that meets the stated needs and requests of the user is retrieved such that the optimum route and transport facilities up to the destination can be easily selected by considering travel time and other important factors”.

ITS will be used to reduce the number of traffic accidents on the expressways and on ordinary roads by supporting the driver's safe driving and improving the pedestrian's safety. That includes the fast notification and proper traffic restrictions after a traffic accident has occurred. Rapid emergency and rescue activities are also included.

in the meantime public transport organizations will be established and information services will be enhanced to improve the convenience of public transportation.

Third Phase (around 2010)

In the third phase ITS will be developed to a higher level. MLIT (2002) says that the increase of infrastructure and in-vehicle equipment implements the establishment of ITS as a social system. Legal and social systems will be involved in this progress so that the effects will be nationwide.

Fourth Phase (after 2010)

In the fourth phase, which is the final period of this project, all systems of ITS will already have been deployed. A full-scale advanced information and telecommunications society will be established with the nationwide optic fiber network and innovative social systems.

MLIT (2002) says that in this period, the number of automated driving users will have started to increase such that automated driving will be established as a general system.

It is also mentioned that with the help of an accomplished ITS deployment, the number of deaths caused by traffic accidents will significantly decrease from that of the present in spite of increased traffic volumes and density.

In future less traffic congestions are expected on all roads including those within cities combined with pleasant and smooth traveling. Additionally, a reduction in business traffic will permit to relieve the roadside environment and the global environment.

2.4 Finance of ITS

The government budgets promote three major projects: the Vehicle Information Communication System (VICS), the Electronic Toll Collection System (ETC) and the Automated Highway System (AHS).

3 Deployment progress and development of ITS

3.1 VICS – Vehicle Information and Communication System

VICS (Vehicle Information and Communication System) is a digital data communication system that promptly provides the latest necessary road traffic information to drivers via car navigation equipment.

The driver gets real-time information like traffic backup situations or traffic regulations. It is not necessary to pay for a piece of information. Charge is included in the cost for equipments. Japanese drivers have the benefit of VICS. At the same time it is a principal solution to reduce problems of traffic congestions.

The VICS Center processes and edits information about traffic congestions, road control and other traffic information. All information is sent in words and graphics to the navigation devices installed in vehicles.

“VICS is a constituent of the Advanced Mobile Information System (AMIS) in traffic information supply activities carried out by the police, the traffic administrator” [INSTITUTE OF URBAN TRAFFIC RESEARCH, no year].

3.1.1 History

The National Police Agency, the Ministry of Posts and Telecommunications (present: Ministry of Public Management, Home Affairs and Telecommunications) and the Ministry of Construction (present: Ministry of Land, Infrastructure and Transport) established the "VICS Consultative Liaison Council" in March 1990. In October 1991, 203 corporations and organizations one year later established the “VICS Promotion Council”.

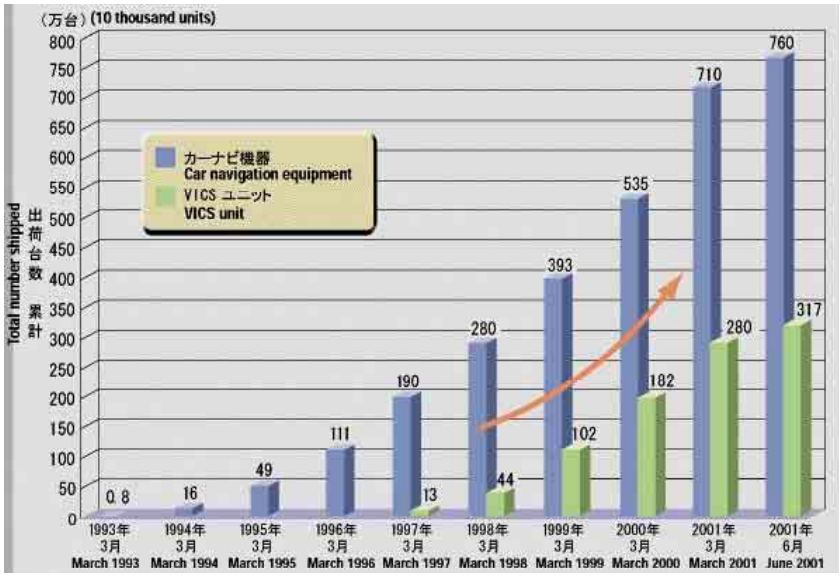
In 1993 and 1995 VICS held open demonstrations and Public experiments and the VICS Center was opened.

VICS service was introduced in April 1996 in the Metropolis of Tokyo, Saitama Prefecture, Chiba Prefecture, Kanagawa Prefecture and Tomei & Meishin expressways. Since then road traffic information have been provided and the service has been improved until today.

In March 1998 the VICS service was expanded to all expressways nationwide and to ordinary roads in other prefectures with large cities by the end of 2001. Thus VICS can be used in 32 prefectures. The nationwide service on all roads in Japan will be introduced in the year 2003, seven years after the introduction in April 1996 [SAKAMOTO 2002]. A map of all areas covered by the service of VICS can be found at the end of the essay (**Attachment 1**).

The number of vehicles equipped with VICS-compatible car navigation equipment reached 3.17 million VICS units in June 2001. At present 84% of retained motor vehicles and about 86% of drivers' license holders in Japan receive services from VICS [HIDO 2001].

Picture 1 shows the increasing number of VICS units compared to car navigation equipment:



Picture 1: Development of VICS units [HIDO 2001]

3.1.2 How VICS works

The VICS Center is the key station where all information is collected. The highway

administrators and the prefectural police give the collected information to the Japan Road Traffic Information Center. This Center forwards them to the VICS Center where other information like the availability on parking is collected.

The task of the VICS Center is to process and edit all information. It systematically connects all information from the roads and sends them from beacons set up on roads, using infrared rays on main trunk roads and radio waves (quasi-microwaves) on expressways. The providing of the road traffic information needed by drivers is made possible by the use of radio beacons on expressways and optical beacons on major trunk roads. The FM multiplex broadcasting via FM radio waves provides information on road traffic conditions. Now information is available to the drivers and they can use them in their vehicles.

The process of information described above can be divided in four functions:

- Collection of information
- Processing and editing of information
- Providing of information
- Utilization of information

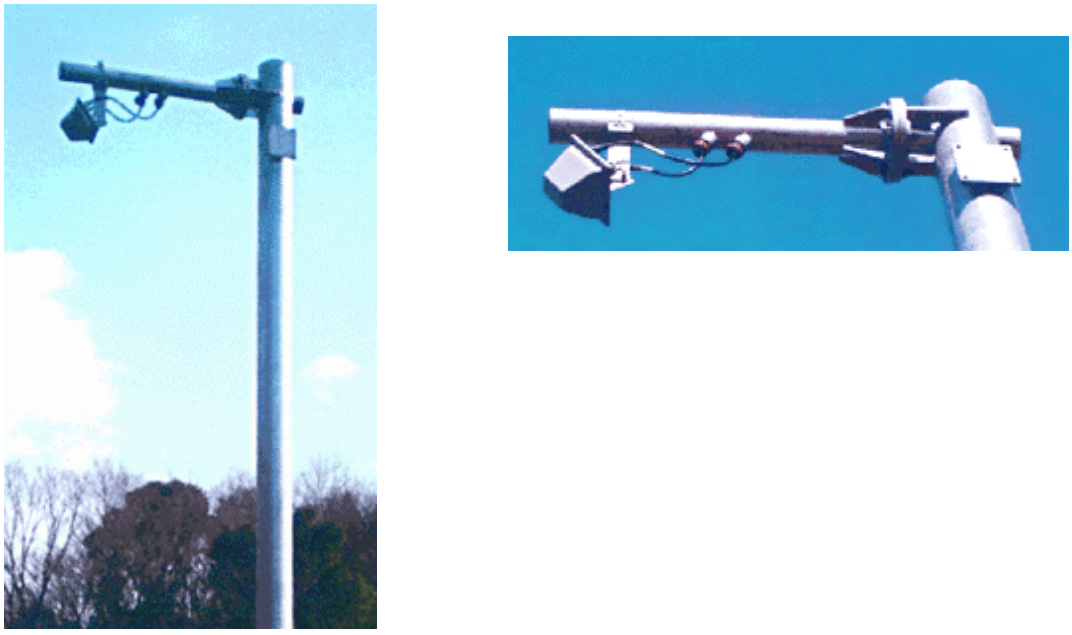
The following **picture 2** shows all information provided by VICS.

Picture 2: Challenge by VICS [HIDO 2001]

3.1.3 Equipment

The equipment contains radio beacons along the roads and on-board devices in the vehicles.

Collecting traffic data:



Picture 3: Radio beacon and close-up picture of the beacon antenna [OKI 2002]

Information shown on the on-board equipment:

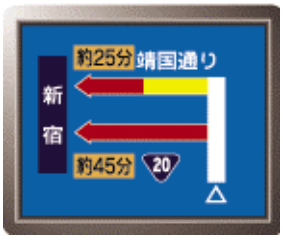
There are three different on-board equipments, which supply different depth of information. The three levels are described in the following chapter in detail.

Level 1: Information is only displayed in text form on installed devices. **Picture 4** shows the graphic display screen in level 1:

Picture 4: Text display in level 1 [VICS 2002]

Level 2: Information is shown by simple graphics on the display of installed devices. The released information covers congested routes and driving times. **Picture 5** shows the graphic display screen in level 2:

Beacon-use



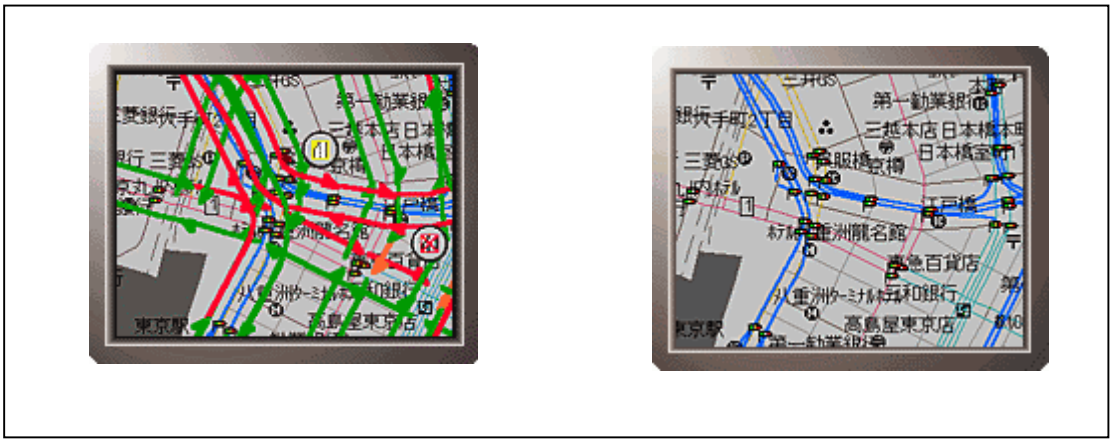
General roads | Inner-city expressways | Expressways between major cities

FM multiplex broadcast-use

General roads | Inner-city expressways | Expressways between major cities

Picture 5: Map display in level 2 [VICS 2002]

Level 3: The traffic information is edited and shown on a map screen of the installed navigation system. The driver can see both their vehicle location and traffic congestions. Different points of views are offered i.e. a 3D-view of the surrounding. Spontaneous route changes are directly worked up in the presentation. Picture 6 shows the graphic display screen in level 3:



With VICS information | Without VICS information

Picture 6: Map display in level 3 [VICS 2002]

3.2 ETC – Electronic Toll Collection

Toll collecting stations are one of the major causes of traffic congestions. That is why the electronic toll collection is one of the main focuses in ITS developments. The Japanese Government is keen on developing systems that public highway corporations are supposed to use.

When ETC services started in Japan three major aims were followed by the government: the alleviation of traffic congestion near tollgates, a better convenience of drivers by eliminating the need to handle cash and the reduction of management costs.

An ETC system has to handle complicated toll systems with different amounts of charge according to the type of vehicle and distance traveled. Furthermore, on-board equipment must be used on numerous toll roads managed by different administrative bodies.

3.2.1 History

The Ministry of Construction and four expressway public corporations have worked out a plan to introduce ETC technology in Japan. This group was initiated in 1995 to force ETC research. Five years later, on March 30th, 2001, the ETC service for general users started with 63 tollgates in several areas including Chiba Prefecture.

The ETC research was aligned to four main demands and requests:

- The system had to be available to users nationwide and compatible for transactions on all toll roads in Japan,
- The acceptance of a 5.8 GHz-band active system to a DSRC (Dedicated Short Range Communications) system to ensure precise interactive communication between the vehicles and roadway units,
- The introduction of an IC card, which is used as well on-board equipment and which is coping with future functional development and allows multi-purpose use,
- The development of an IC card that allows mutual verification with other terminal equipment and coding of recorded data for high security.

Four months after the introduction of ETC tollgates, 146 tollgates were equipped with ETC devices in three major urban areas. At the end of the year 2001 the number of toll gates increased to 600 tollgates nationwide and will reach the number of 900 by the end of fiscal year 2002.

3.2.2 How ETC works

There is a system communication between the tollgate and the vehicle. An antenna of the ETC system is installed at a tollgate and a device is installed on vehicles (on-board equipment).

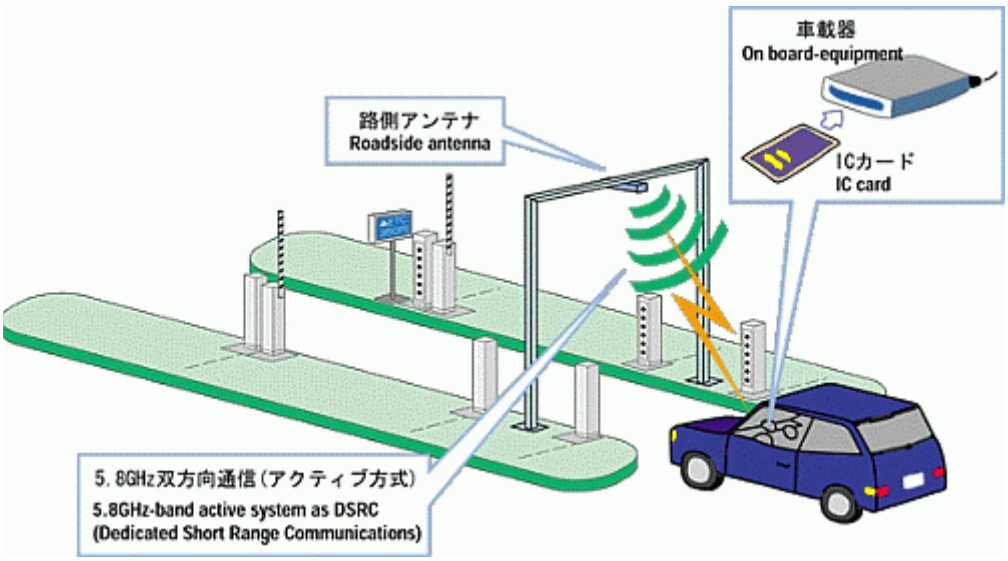
When a vehicle is driving through the tollgate, a signal is sent to the antenna so that the toll will be paid automatically. Vehicles can pass through this gate without having to stop.

Generally, ETC systems have to support different toll systems: open and closed systems. In open systems the toll fee is paid at the entry toll plaza, while in closed systems the amount of the toll fee depends on the distance between the entry and the exit toll plaza.

The main advantages of the ETC system are that drivers are free from the inconvenience of stopping in order to pay at tollbooths and that vehicles can pass faster through the tollgates. The consequence of not paying cash is that the use of toll roads becomes more convenient.

The use of an ETC system can imply a reduction in management and construction costs. The ETC System can presently be used on toll roads throughout Japan and an improvement of all tollgates by 2002 is intended.

Picture 7 shows how the ETC system works:



Picture 7: The ETC system [HIDO 2001]

In future, “all tollgates will be fitted with a card reader capable of reading the electrically transmitted information of the IC card (Intelligent Circuit card) inserted in the on-board equipment” [HIDO 2001].

3.3.3 Equipment

There are three integral parts of the ETC System – the ETC card, the car transmitter and the ETC antenna at the tollgate. These devices are described in the following paragraph.

ETC card

The ETC card is a card issued by a participating credit card company. It is inserted into the transmitter on-board and a charge is placed automatically on the card when passing through the gate. The card must be obtained from one of the participating companies.

Car transmitter

The transmitter is generally installed on the control panel of the car and it communicates with the antenna at the tollgate. The transmitter can be purchased at most dealers and car part shops and is installed at shops with the ETC logo.

ETC antenna

The antenna in the ETC lane almost instantly collects travel information from the transmitter, calculates the payment needed and charges the card for the toll. The tall collecting process is transacted faster than by a money collecting process. Queuing time can be reduced by this system.

Picture 8 illustrates the on-board equipment and a tollgate for ETC use only.

Picture 8: Ob-board equipment with IC card and example of ETC in operation [HIDO 2001]

There are different modes of tollgates: a tollgate with exclusive ETC lanes, a mixed tollgate for ETC users and ordinary payment drivers and the current money collecting tollgates. These three types of tollgates are differently marked. The signs are described more detailed in the following part of this chapter.

ETC signs which are used in front of tollgates:

This sign indicates an exclusive ETC lane. Individuals seeking to pay tolls through ordinary means may not use this lane. If a driver enters it by mistake, he has to use the intercom to call tollgate personnel. [**Picture 9**: JH 2002]

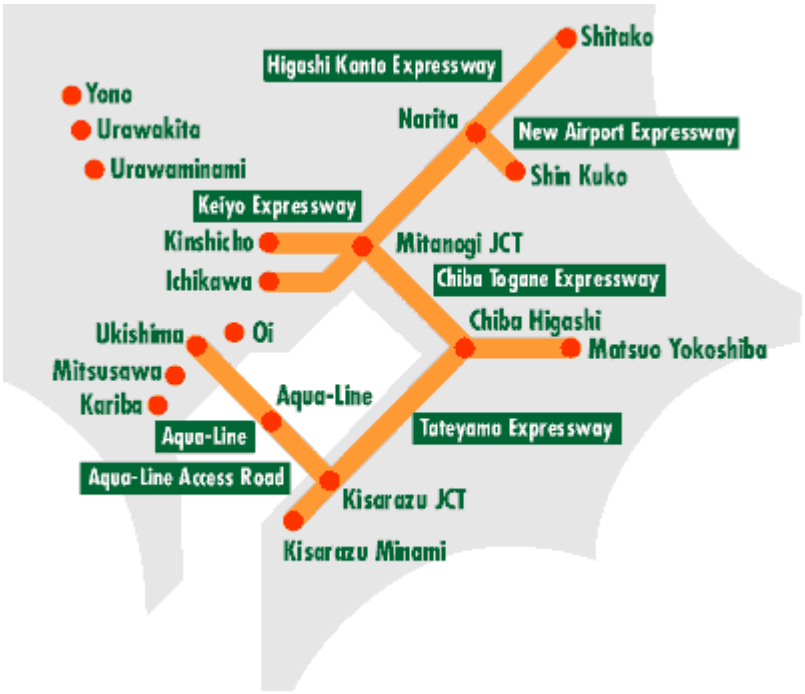
This lane can be used both by cars utilizing ETC and for ordinary payment means. Since these cars will be intermingled, the driver must exercise extra caution when traveling through them. [**Picture 10**: JH 2002]

The signs above may possibly change depending on the hour of day. Consequently, one has to verify the lane's classification prior to entering it.

This is a sign that has been installed to guide individuals participating in ETC-to-ETC lanes. [**Picture 11**: JH 2002]

ETC has also been implemented in Chiba and Okinawa and usage is gradually expanding but the required effects are quite low at the moment (the number of users is about 10 % compared to no-ETC users [WARITA 2002]). The on-board equipment is high-priced because there is no mass production yet. Furthermore, there are no financial incentives to use the ETC system. The number of tollgates with ETC systems is low compared to general tollgates. Drivers have to pass the same traffic congestion in front of a tollgate to reach the ETC gates during the peak hours.

Picture 12 illustrates the present ETC areas in the region of Tokyo and Chiba:



Picture 12: Present areas of ETC tollgates in the region of Tokyo and Chiba [JH 2002]

4 Integrated Traffic Control Systems (ITCS)

Traffic control systems on surface roads were introduced in traffic control centers operated by the Prefectural Police Headquarters. Since 1996, about 170 centers have been installed and have been operating 24 hours a day. The National Police Agency works close together with the Metropolitan Expressway Corporation and the Universal Traffic Management Society of Japan (UTMS). Further improvements of the traffic control are still in progress.

4.1 History

The fundamental research on traffic control in Japan has started in 1961. But it took eight years until the first Traffic Control System was introduced by fundamental experiments such as data collection.

After those experiments had been successful, the realization of the first Traffic Control System for research and development in Tokyo started in 1970. This system included automatic data collection and the introduction of variable message signs.

In the following years, the Traffic Control System has been extended and developed including the introduction of traffic regulations and the providing of information automatically. In the beginning of the eighties the Traffic Control System could be separated into East and West Tokyo area and a new method aiming at more rapid and accurate providing of data was installed. At the same time the installation of Graphic Information Boards was made.

The Traffic Control Center has been improved with better techniques several times during the last fifteen years: new Traffic Control Centers were introduced, the control and exchange between different areas were improved and new possibilities of gathering and providing information have been developed.

Since 1995 quick countermeasures in emergency, the unification of information and the information service of travel time through the congested areas by variable message signs are have been realized.

4.2 Traffic Control System

The traffic control system has three main functions: collection, processing and presentation of traffic information. These basic functions are described as follows:

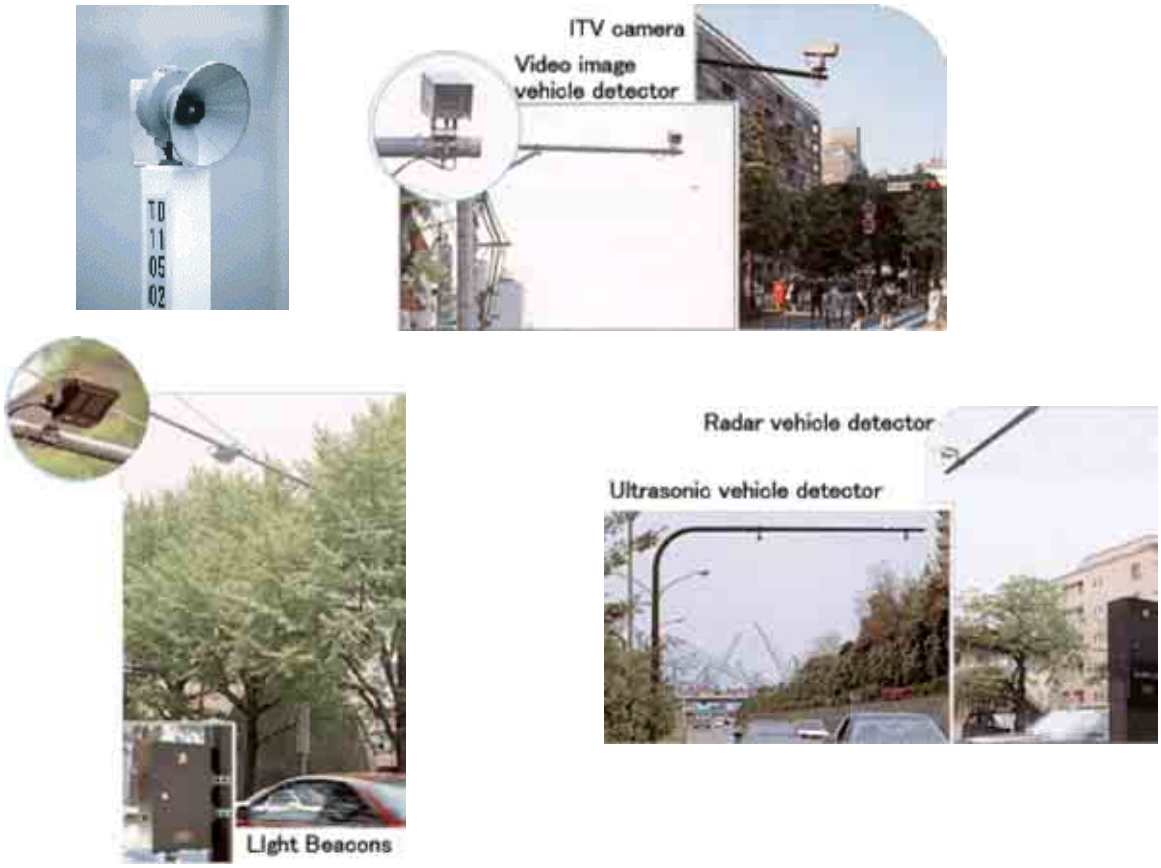
4.2.1 Collection of traffic information

Roadside traffic sensors collect the traffic information. Additionally, helicopters, patrol cars and police motorcycles supervise the street network and send their information to the control center. The 110 Communication Command Centers are directly connected. Police stations, police boxes and television cameras complete the collection of traffic information.

The traffic control center “receives various information about traffic conditions such as traffic volumes, congestion lengths and travel times” [Institute of Urban Traffic Research, no year].

Vehicle detectors:

Vehicle detectors are used to count the number of passing vehicles and to detect their speed. They also detect the presence of vehicles by emitting ultrasonic waves periodically from the detection head. At the same time they receive waves reflected by the passing vehicle. Various vehicle detectors are in use, including ultrasonic, infrared (optical beacons), radar and loop vehicle detectors. The most common is the ultrasonic vehicle detector.



Picture 13 shows a vehicle detector:

Picture 13: Vehicle detectors [on the top left: HIDO 2001, others: KANAGAWA PREF. POLICE 2002]

The vehicle detectors are installed at 300 m intervals along Tokyo Metropolitan expressways. They are also installed along the access ramps. All collected data are immediately sent to central processing units through telecommunication lines. At the end of 1997, the installed number of vehicle detectors in Japan was more than 110,000 units. The types of vehicle detectors in 1997 were the following:

Type of detector	Units
Ultrasonic vehicle detectors	88,000
Infrared vehicle detectors (optical beacon)	18,000
Radar vehicle detectors	4,500
Image processing vehicle detectors	1,2000
Bus detectors	1,100
Travel time measuring (AVI) terminals	800 (570 sections covered, or app. 4,100 km)
CCTV cameras	2,100

Table 3: Vehicle detectors in Japan [after INSTITUTE OF URBAN TRAFFIC RESEARCH, no year]

Weather surveillance equipment:

Weather information data are collected with the help of weather surveillance equipment. Especially on high bridges over rivers anemometers are installed to measure wind direction and velocity. Road surface hygrometers and thermometers, ultrasonic snow depth measuring devices, snowfall detectors and rainfall sensors are also used on expressways. **Picture 14** shows weather surveillance equipment:

Picture 14: Weather surveillance equipment [MEX 2001]

All collected road data are sent to the traffic control centers. The data are provided to drivers through various message signs installed along the roads.

TV camera for traffic control:

Picture 15 shows a TV camera for traffic control, which can be found along the expressways.

Picture 15: TV camera for traffic control [HIDO 2001]

4.2.2 Processing traffic information

All collected information is processed as follows [after TMPD 2002a]:

- Control of the intervals of the signal (red/green) in ratio to traffic,
- Displaying traffic jams on the Central Display Board,
- Permanent update of the Telephone and Facsimile Information Service and the Traffic News Transmitter,
- Displaying where traffic accidents happen and which streets are closed,
- The Exchange of traffic information with neighboring Control Centers.

Picture 16 shows the central display board in the Traffic Control Center of the Tokyo Metropolitan Police Department.

Picture 16: The Central Display Board in the Traffic Control Center [TMPD 2002b]

4.2.3 Presentation of traffic information

The traffic information is provided by the following devices:

- Electric bulletin boards (character information, variable message, present message, formulated information, small (character) information and small (travel time) information boards),
- Traffic Signals,
- Traffic News Transmitter (roadside radio transmitters: drivers can access this information on their car radios at 1620kHz),
- Traffic information service via telephone and fax,
- Information terminals which are installed at public facilities for user convenience,
- Radio Broadcast,
- Information Display Cars.

The following **picture 17** shows electric bulletin boards and a traffic news transmitter.

Picture 17: Electric bulletin boards and a traffic news transmitter (on the right) [HIDO 2001]

The amount of information and the detailed description depends on the on-board equipment. But generally there are five different types of information [Institute of Urban Traffic Research, no year]:

- Congestion status: road name, congestion lengths and degree of congestion,
- Travel times: road names and travel times,
- Incident information: road names, location names, incident information (accidents, traffic regulations, etc.),
- Parking information: location and space availability,
- Wide-area information: messages, cautions, etc.

5 Summary

ITS are pushed forward by four Japanese Government ministries and academic and private companies whose focus is on developing major ITS systems.

The most popular product in a growing list of commercially available ITS technologies is the satellite-based on-board navigational system. One of its applications can be found in the so-called Vehicular Information Communication System (VICS), which uses FM radio wavelengths or a beacon to transmit up-to-the-minute traffic information to anyone with an on-board navigational device.

Another important ITS application is the automatic money collection system for the use on toll roads. Once Electronic Toll Collection (ETC) systems are installed, drivers do not have to stop at tollgates to pay cash any longer. An antenna affixed to each tollgate communicates with automobiles equipped with an electronic card and automatically deduct the fee from the driver's prepaid account.

Meanwhile, the optimization of traffic management is built up. Traffic management includes the controlling of traffic signals depending on traffic volume by improving control centers and centralizing traffic signal controls. But other services like the provision of traffic information or the information service have to be mentioned as well.

Other ITS applications like the support of public transport, the Assistance for Safe Driving or the support for pedestrians will be introduced during the next years. But after 2010 all systems of ITS will already have been deployed. A full-scale advanced information and telecommunications society will be established with the nationwide optic fiber network and innovative social systems.

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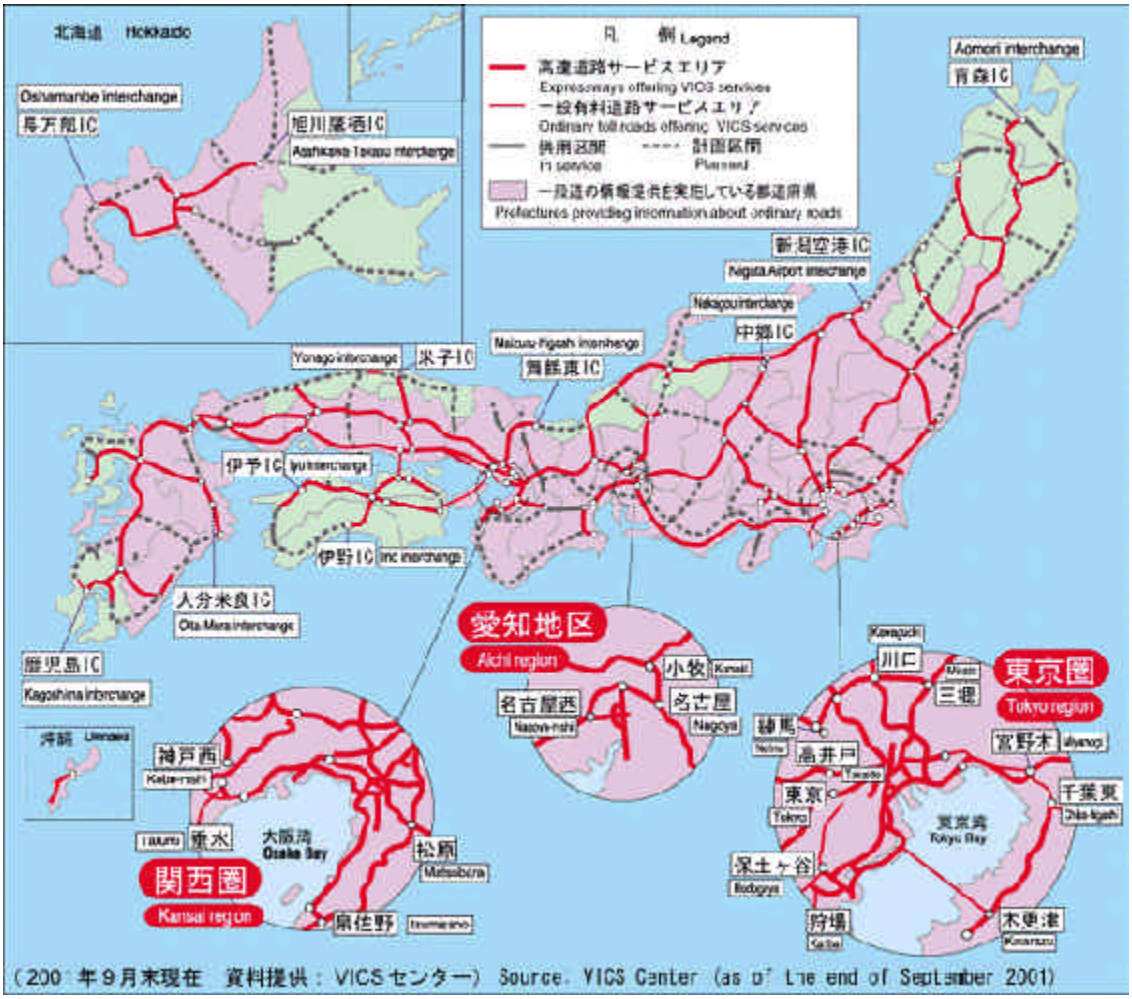
WARITA, Hiroshi

Staff member of the Metropolitan Expressway Public Corporation

Metropolitan Expressway Experience Tour in the Metropolitan Area of Tokyo on July 1st, 2002

Attachment 1

All areas covered by the service of VICS in 2001:



Source: HIDO 2001