Chapter I　Current status of ITS promotion

1. Objectives of ITS promotion

Five ministries and agencies in charge of ITS -- the Ministry of Posts and Telecommunications (MPT), the National Police Agency (NPA), the Ministry of International Trade and Industry (MITI), the Ministry of Transport (MOT) and the Ministry of Construction (MOC) -- formulated the "Comprehensive Plan for ITS in Japan" in July 1996, which describes the following objectives of ITS promotion.

First of all, Intelligent Transport Systems (ITS) can be regarded as a comprehensive info-communications system dealing with road traffic and transportation. ITS is a key to solving transportation problems faced by the Japanese public, and could alleviate traffic congestion, reduce traffic accidents, improve distribution efficiency and contribute to preservation of the global environment. Meanwhile, the 21st century will certainly see various social problems looming ahead as the society ages and the birth rate as well as the number of productive laborers decrease. Under the circumstances, creation of new road traffic/transportation system that will reduce the burden on drivers is eagerly awaited; ITS can meet such demand greatly.

Second, ITS is a policy dealing with roads that cover every part of Japan and the operation of nearly 70-million vehicles nationwide. It is expected that developments in such ITS-related sectors as automobile and high-tech industries will have significant ripple effects on the Japanese economy, for instance new business creation, at a time when economic difficulties are forecast to continue in Japan for yet awhile. ITS is expected to grow into the core multimedia mobile communications technology with huge market potential in the 21st century. Hope runs high for the future success of ITS-related businesses resulting from the creation of a variety of applications, just as mobile phones and other mobile communications systems have succeeded.

Third, ITS can showcase a clear example of an advanced info-communications society to the Japanese people, through road traffic/transportation system being closely related to their daily lives. ITS is a policy dealing with roads, traffic flow and vehicles, with which the entire population have great association upon travelling. Thus, ITS is expected to play a leading role in creating an advanced info-communications society, where every citizen is ensured of leading a happy life through use of state-of-the-art info-communications technologies.

This report will discuss not only the aforementioned objectives of ITS promotion, but also those listed below, with a special emphasis on the relationship between ITS and info-communications technologies.

Primarily, ITS is seen contributing to the revitalization of local communities. As one form of info-communications systems, ITS can make communities livelier through dispatch of interesting local news/information to the outside world and through improved convenience for residents. At the same time, each community is expected to play an important part in ITS promotion, by developing a variety of ITS applications tailored to the needs of the community.

In a secondary manner, ITS has been promoted not only by Japan, but also by the U.S. and countries in Europe, with a considerable amount of resources being expended by these countries. In this respect, ITS is one of several remaining large-scale international projects, which can bring on a dynamic and intense international competition behind the scenes in the field of technological development and international standardization. Japan should seize this opportunity to take the lead in the international arena through ITS promotion.

In short, ITS is a national project that deals with roads, transportation, vehicles as well as info-communications technologies that can only be promoted through close collaboration and cooperation of the government, industry and academia, not only the previously mentioned five ministries and agencies. The success of ITS largely depends on how the collaboration proceeds among all parties involved. They should thus work closely, being aware of the significance of this project and the wide attention it has drawn, in order to make this project a successful example of government-industry-academia collaboration for a state-run project.

2. Measures adopted in Japan

(1) Basic Guidelines on the Promotion of an Advanced Information and Telecommunications Society

In February 1995, the Advanced Information and Telecommunications Society Promotion Headquarters chaired by the Prime Minister decided upon the "Basic Guidelines on the Promotion of an Advanced Information and Telecommunications Society." These guidelines advocated promotion of informatization for the road, traffic and vehicles in the advanced info-communications society, and specified the basic policy for ITS promotion in Japan for the first time. These guidelines defined ITS as the driving force for "introducing information technology (IT) into the public sector," indispensable upon promoting the creation of an advanced info-communications society. Furthermore, the guidelines recommend comprehensive and systematic promotion of: 1) the Vehicle Information and Communications System (VICS), 2) R&D and standardization activities on ITS info-communications-related technologies, and 3) international cooperation concerning ITS.

These guidelines were revised in November 1998 to include the new headings of "Promotion of VICS advancement (???)" and "ITS promotion in local communities (??)," revamping the government's ITS policy.

Excerpts from the Basic Guidelines on the Promotion of an Advanced Information and Telecommunications Society (revised)

5) Informatization in road, traffic and vehicles

Making full use of state-of-the-art info-communications technologies, ITS will build systems encompassing roads and vehicles in unison. ITS can be expected to have a great impact on socioeconomic activities, alleviating such problems as traffic jams, traffic accidents and damages to the global environment while improving distribution efficiency, in addition to creating new businesses.

To fully implement ITS, the following measures should be pursued comprehensively and systematically:

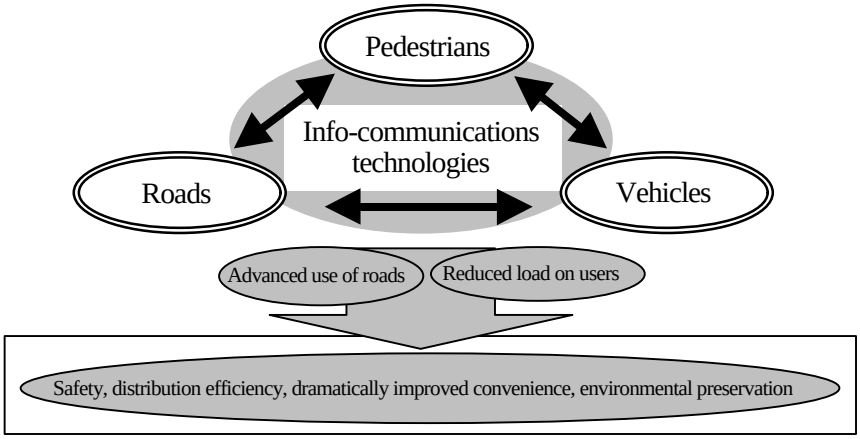
- For VICS, which is already in operation, further efforts should be made to expand the service coverage nationwide and to advance the system capabilities.
- Based on the "Comprehensive Plan for ITS in Japan," R&D/verification experiments on ITS info-communications technologies, introduction of ITS into local communities and standardization activities on ITS both at home and abroad shall be promoted to realize the Electronic Toll Collection (ETC) systems, support for driving safety, optimization of traffic management , improved road management efficiency, support for public transport and improved efficiency in commercial vehicle operations (CVO).
- Information exchanges at international conferences as well as international cooperation in setting standards shall be pursued for ITS promotion.

(2) Comprehensive Plan for ITS in Japan

Following the "Basic Guidelines on the Promotion of an Advanced Information and Telecommunications Society" compiled by the Advanced Information and Telecommunications Society Promotion Headquarters, five Japanese ministries and agencies in charge of ITS -- MPT, NPA, MITI, MOT and MOC -- formulated the "Comprehensive Plan for ITS in Japan" in July 1996.

The Comprehensive Plan notes the importance of its formulation on the ground that such a national project as ITS requires strategic and comprehensive tasks mapped out under a grand concept. The Comprehensive Plan presents a long-term ITS vision for the next 20 years, comprising fundamental concepts for the ITS development and deployment plan as well as for ITS's target functions. Specifically, the Comprehensive Plan has defined 20 user services in nine areas essential to the development of ITS as shown in Fig. 1-2, clarifying the goals of government-industry-academia collaboration for each of the nine R&D areas.

Fig. 1-1 ITS concept defined by the Comprehensive Plan



(Source: The Comprehensive Plan for ITS in Japan)

Fig. 1-2 Twenty user services and nine R&D areas in the Comprehensive Plan

R&D area	User services
1. Advances in navigation systems	1) Provision of traffic information 2) Provision of destination information
2. Electric Toll Collection (ETC) systems	3) ETC
3. Assistance for driving safety	4) Provision of cruising-environment information 5) Danger warnings 6) Driving assistance 7) Automated driving
4. Optimization of traffic management	8) Optimization of traffic flow 9) Provision of traffic control information in the aftermath of traffic accidents
5. Increased efficiency in road traffic management	10) Improved efficiency in road condition maintenance/management 11) Management of special vehicles 12) Provision of traffic control information
6. Support for public transport operation	13) Provision of information on public transport usage 14) Support for public transport operations/operational management
7. Increased efficiency in commercial vehicle operations (CVO)	15) Assistance for commercial vehicle operations 16) Uninterrupted automated driving of commercial vehicles
8. Support for pedestrians	17) Route guidance 18) Hazard prevention
9. Support for vehicle operations during emergencies	19) Automated emergency reporting 20) Vehicle route guidance and vehicle relief support during emergencies

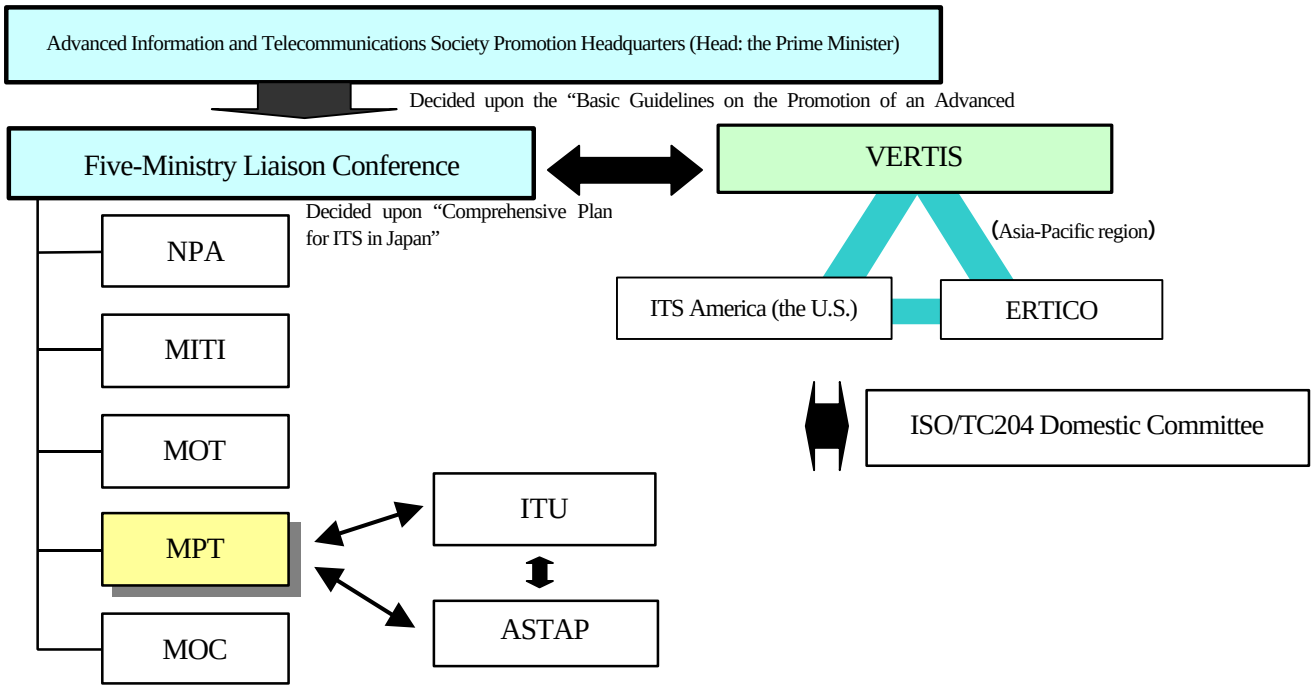
(3) Structure for promoting ITS in Japan

Because such wide-ranging fields as road, traffic, vehicles and info-communications are covered by ITS and their coverage thus transcends boundaries of industrial sectors, as a national project ITS could only be promoted through close cooperation of the government, industry and academia.

Under the leadership of the Advanced Information and Telecommunications Society Promotion Headquarters, the five Japanese ministries and agencies in charge of ITS have taken a leading role for full implementation of ITS in Japan while promoting collaboration among the government, industry and academia, as well as with other countries involved. The ministries and agencies have been holding a monthly Five-Ministry Liaison Conference to deal efficiently with ITS-related problems. The conference has been an important occasion for opinion exchange and coordination among the officials in charge of ITS.

Meanwhile, as an initiative of Japanese industries and academia, the "Vehicle, Road and Traffic Intelligence Society (VERTIS)" (Chair: Mr. Shoichiro Toyoda, Chairman of the Toyota Motor Corp.) was formed by scholars, private companies and relevant organizations. VERTIS exchanges information with relevant Japanese organizations as well as with scholars in cooperation with the Five-Ministry Liaison Conference. VERTIS also serves as a liaison for ITS-related organizations in the U.S. and Europe as a representative of the Asia-Pacific region.

Fig. 1-3 Structure for promoting ITS in Japan



There are several standardization organizations dealing with ITS info-communications systems. Among them are the International Telecommunication Union (ITU), a treaty organization responsible for world's telecommunications standards; the International Organization for Standardization (ISO), which defines international industry standards such as for the mining and manufacturing industries; and, the Asia-Pacific Telecommunity [APT] Standardization Program (ASTAP). In addition, there are Japanese organizations, each closely related to these international standardization organizations.

In addition, R&D activities and surveys on ITS have been conducted by Vehicle Information and Communication System Center (VICS Center), Association of Radio Industries and Businesses (ARIB), Advanced Cruise-Assist Highway System Research Association (AHSRA), Association of Electronics Technology For Automobile Traffic and Driving (JSK), Universal Traffic Management Society of Japan (UTMS) and other organizations.

(4) Specific measures implemented

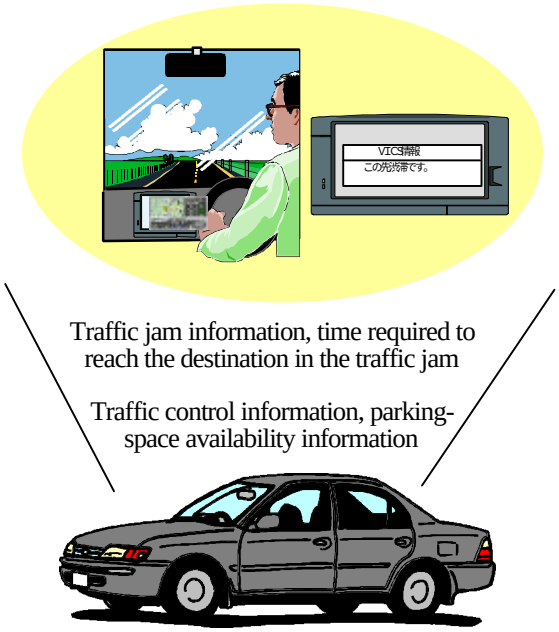
(a) Vehicle Information and Communications System (VICS)

VICS was introduced in Japan in April 1996 ahead of any other country through the efforts of MPT, NPA and MOC. VICS provides drivers with realtime traffic information such as traffic jams by making use of FM multiplex broadcasting, radiowaves and optical beacons. VICS is now in operation on expressways throughout Japan and on regular roads in nine prefectures.

Compared with the conventional car navigation systems, these being limited to guiding routes to destinations only, VICS offers the additional feature of enabling use of flexible driving patterns, depending upon ever-changing traffic conditions. To sum up, VICS advances the existing car navigation systems.

VICS has been adopted rapidly in the past two years since the initial service launch. As of the end of 1998, some 3.7 million vehicles were equipped with car navigation systems, with 900,000 or so using VICS. Under the circumstances, studies began on ways to expand the VICS service coverage and to advance systems that meet the needs of users.

Fig. 1-4 VICS service image



(b) Electronic Toll Collection (ETC) – an automatic highway-toll collection system

ETC system consists of a car-borne ETC radio device placed on the dashboard, an IC card inserted to this device, and roadside antennas installed at the toll collection gate. ETC enables automatic toll collection without the need to stop vehicles at toll collection gates on highways through use of radiocommunications between roadside antennas and car-borne ETC devices. The actual installation of antennas, devices and other equipment for ETC is planned to start by fiscal 1999 (ending March 31, 2000).

The systems being developed are to be used specifically for ETC. Nevertheless, the wireless card technology, one feature of the ETC system that uses the 5.8-GHz band frequencies, is versatile. Because the technology is applicable for location detection and some other information provision services, it is seen being utilized for various other purposes, such as parking-lot management and physical distribution control.

Under the circumstances, a two-year R&D program was initiated in fiscal 1998 to enhance versatility of ETC technology. One focal theme has been to realize the Dedicated Short-Range Communications (DSRC), which refer to short-range, bi-directional mobile communications that are interoperable with various other applications.

Fig. 1-5 ETC system image

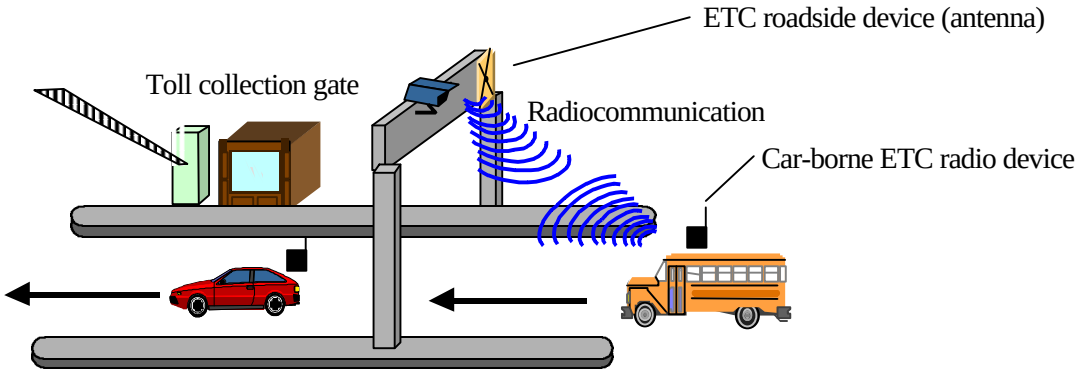
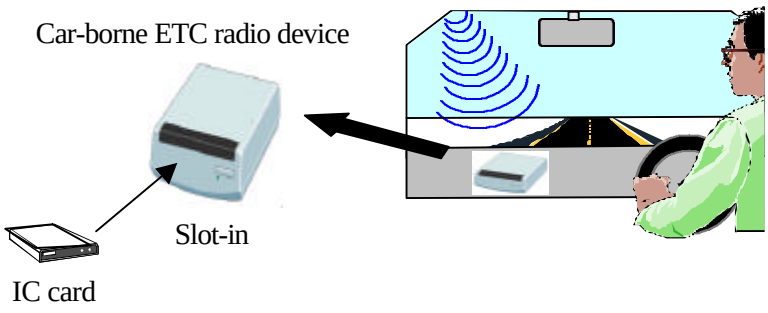


Fig. 1-6 ETC system inside the automobile



(Reference) DSRC

As indicated in Fig. 1-7, DSRC refers to short-range, bi-directional mobile communications interoperable with various other applications. DSRC has been realized as part of VICS, and is one of integral systems of ITS info-communications systems. Being developed by MPT and other organizations involved, DSRC technology is seen being used not only for ETC, but also for various other purposes in parking lots, distribution centers, gas stations, convenience stores and so on. It is also expected that DSRC will become the key technology in the area of car navigation.

Advantageous features of DSRC include:

(1) enabling the provision of large-capacity, bi-directional communications at several Mbps (→ this enables the downloading of ITS information including pictures and images)

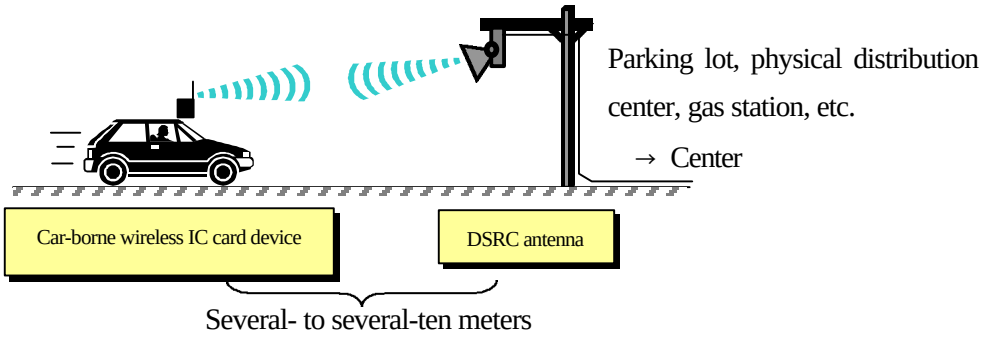
(2) enabling the aiming of a specific vehicle in the several- to several-ten meter range and accurate transmission of information toward it thanks to DSRC's small coverage
(→ this enables the handling of respective cars in a charged parking lot, for instance)

(3) making usable various applications such as parking-lot management and physical distribution control
(→ this enables adoption of DSRC into various areas that will eventually lower costs of developing car-borne devices and other equipment)

(4) enabling systems to become totally automatic (unmanned) after the introduction
(→ this realizes reductions in management costs in distribution as well as other various purposes)

(5) enabling account settlement through use of radiocommunications
(→ this could realize advanced electronic account settlement involving use of IC cards)

Fig. 1-7 Image of DSRC



Use of DSRC has also been promoted in the U.S. In July 1998, the Federal Communications Commission (FCC) proposed allocation of frequencies in the 5.8-GHz band (5.850 - 5.925 GHz) for DSRC to be used with ITS. FCC plans to set rules for the frequency allocation, licensing guidelines and other items by January 2000. In line with this, the ITS America has taken a leading role in the discussions concerning the requirements for frequency specifications, based on the following DSRC application examples.

- Electronic payment services
- Commercial Vehicle Electronic Clearance (inspections concerning vehicle weight, their load type as well as vehicle safety)
- Traffic control
- Transit Vehicle Signal Priority, Emergency Vehicle Signal Preemption
- En-route Driver Information
- Public Transportation Management
- Freight Mobility
- Highway-Rail Intersection

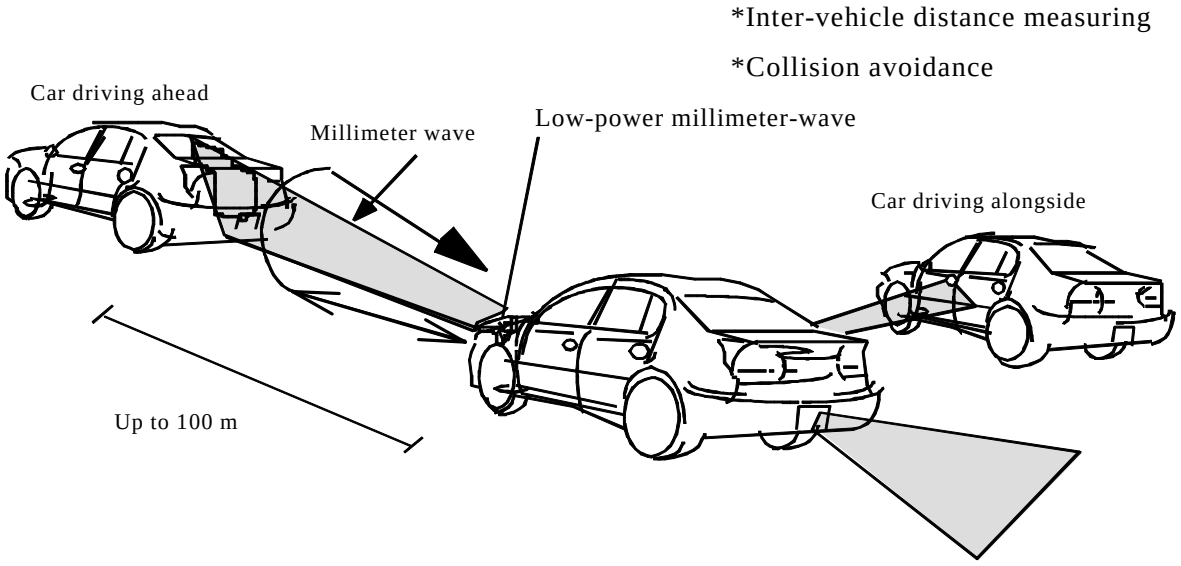
(Source: "Notice of Proposed Rule Making," June, 11, 1998, by FCC)

(c) Support system for driving safety

Low-power millimeter-wave radar that uses radiowaves in the 60 or 76-GHz band is one of communications devices applicable for driving safety support systems. Technical standards for the radar were all set in fiscal 1997.

For use with ITS, the radar is mounted on a car to detect obstacles on the road and to measure distance from the car in front of it. The radar sends alarms to drivers to avoid collisions, assists driving in cooperation with vehicle's mechanical control systems such as the braking system, and in the future, will enable totally automatic driving.

Some of the radar's parts are already manufactured and mounted on specially designed vehicles. Nonetheless, wide adoption of the radar for cars in general is projected in the near future.



(d) Promoting ITS model district experiment project

To measure ITS's favorable impact on the society, the five ministries and agencies in charge of ITS have jointly been conducting feasibility studies (e.g., preemptive research and designing) since fiscal 1997 on experiments being carried out in ITS model districts. These studies are planned to continue through the end of fiscal 1999.

In fiscal 1998, four leading communities and one organization (Kochi, Gifu and Okayama Prefectures, as well as Toyota City, in addition to the Tokyo Metropolitan Police Board) were designated as ITS model district candidates. From fiscal 1999, the ministries and agencies, in accordance with their own jurisdiction, will extend the necessary support for respective experiments being carried out in these model districts. The ministries and agencies also plan to widely publicize the proceedings and outcome of this project.

Fig. 1-8 Selected ITS model districts and experimental themes

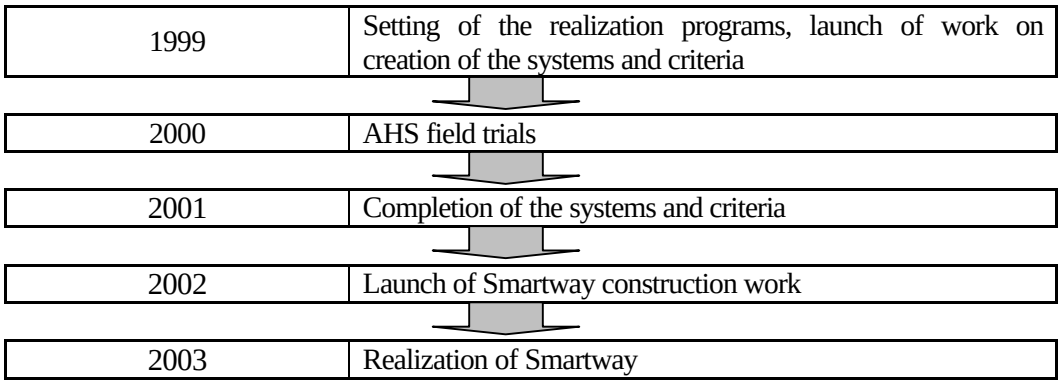
Local autonomous body or organization in charge	Experimental theme
Toyota City (Aichi Prefecture)	ITS model district experiments -- IN Toyota
Kochi Prefecture	ITS proposals from KoCoRo (Kochi Communication Road) area
Tokyo Metropolitan Police Board (Tokyo Metropolis)	Efficiency verifications experiments on the public transport priority system (PTPS) in urban districts within the metropolitan area
Gifu Prefecture	・Creation of the "recycling society" through use of mobile communications ・Feasibility study on Gifu Prefecture's ITS-related information provision system through use of private-sector initiatives
Okayama Prefecture	ITS model district experiment in Okayama Prefecture

(e) Smartway (intelligent road) Project and Advanced Cruise-Assist Highway Systems (AHS)

Smartway is a concept of epoch-making roads in the 21st century, on which dramatically improved safety and traffic flow are to be ensured through integration of state-of-the-art ITS technology. The aim of Smartway is to serve as the platform, upon which a variety of ITS services for various purposes are to be realized. In this regard, the Ministry of Construction played a leading role in organizing the "Smartway Project Advisory Committee." The committee convened its first meeting this February and will release its proposals for realization of Smartway in June 1999.

Smartway is planned for implementation through several steps. By 1999, the realization programs will be set and work will begin on the establishment of relevant systems and criteria. In 2000, field trials on AHS will be conducted, and the finalizing of the systems and criteria is scheduled for the year 2001. Smartway is anticipated to contribute to new and sound deployment of ITS in the 21st century.

Fig. 1-9 Implementation schedule of the Smartway Project



Meanwhile, Advanced Cruise-Assist Highway Systems (AHS) provide support for vehicle functions as well as drivers in judging driving conditions, through combined use of the road infrastructure and info-communications systems.

For instance, AHS can avoid obstacles ahead of the vehicle by controlling the vehicle's cruising via radiocommunications between the vehicle and devices installed alongside roadways. In a nutshell, AHS is aimed at achieving totally automatic, unmanned driving. In Japan, in the September 1996 AHS experiment, the tested vehicle was successfully driven unmanned inside the lanes, avoiding collisions with other vehicles for 11 kilometers on a round-trip on the closed section (then) of the Joshinetsu Expressway, from Komoro Interchange to Tobu-yunomaru Interchange.

AHS is one of the most technically advanced systems adopted for ITS. The AHS development is handled in three phases, as shown in the Fig. 1-10, while continuing R&D promotion.

Fig. 1-10 AHS systems

AHS - *i (information)*	Information provision system, which detects road conditions ahead (e.g., frozen roads) and notify the driver of such information to allow the driver to avoid the yet unseen dangers
AHS - *c (control)*	Control support system detects obstacles on the road or parked cars in advance and controls the movement of the car when the driver fails to quickly respond to these obstacles
AHS - *a (automated cruise)*	Automated cruising system, which enables unmanned car steering

(f) The Smartcar Project: Advanced Safety Vehicle (ASV)

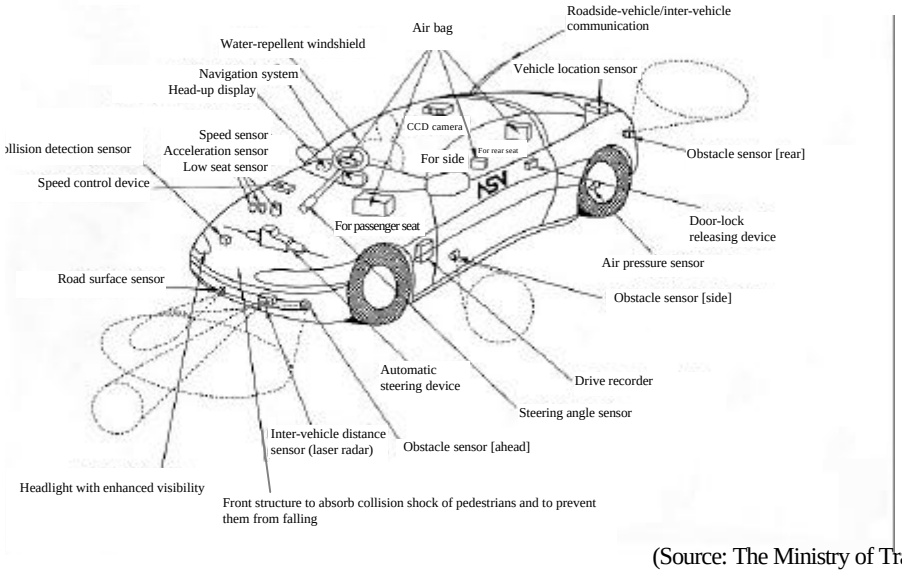
Advanced Safety Vehicle (ASV) refers to very intelligent vehicles with dramatically improved safety, which will be realized by application of cutting-edge electronics technologies that have rapidly advanced. ASV can be used as the vehicles for ITS. The Ministry of Transport established the ASV Promotion Group (?) in fiscal 1991 and has been promoting R&D on ASV.

In its first five-year plan from fiscal 1991, the ministry designated the following four major safe technologies and promoted R&D thereon: 1) preventive safety technology, 2) accident avoidance technology, 3) technology for minimizing damages from collisions, and 4) technology for preventing expansion of damages and havoc in the aftermath of collisions. In March 1996, the ministry conducted a public cruising demonstration of 16 prototype ASVs embedded with most major ASV base technologies.

The ministry has been carrying out its second five-year plan since fiscal 1996. For which the ministry included trucks, buses and two-wheel vehicles as the target vehicles in addition to passenger cars covered in the first plan. The ministry has been promoting R&D work, such as the development of base technologies, optimization of human-machine interface and investigation of ITS's compatibility and interoperability with other types of infrastructure. The second plan has taken up these six major safety technologies: 1) preventive safety technology, 2) accident avoidance technology, 3) full-automatic steering technology, 4) technology for improved safety in collisions, 5) technology for preventing expansion of damages and havoc, and 6) fundamental vehicle technology. Based on these six technologies, the ministry has been researching and developing a total of 32 system technologies.

Respective ASV system technologies are planned for realization by the turn of the century, by embedding them on commercial vehicles one after another. Moreover, R&D work will be continued on the development of a system that control these ASV system technologies uniformly, with the aim of realizing ASV equipped with this comprehensive control system.

Fig. 1-11　Image of ASV (a passenger car)



(Source: The Ministry of Transport)

(g) Universal Traffic Management Systems (UTMS)

Universal Traffic Management Systems (UTMS) provide realtime traffic information to drivers through use of optical beacons that conduct two-way communications with vehicles.　The aim of UTMS is to achieve advanced traffic control through use of the cutting-edge technologies in order to improve safety and smoothness of road traffic (also involving pedestrians), to contribute to the environmental preservation and to enhance convenience of people.

(h) International activities (participation in international standardization activities and ITS World Congress)

Prominent Japanese contributions to the international efforts for ITS promotion include participation and cooperation for the international standardization activities and the ITS World Congress.

1) International standardization activities

International standards for ITS-related technologies are being set by the International Telecommunication Union (ITU), the Asia-Pacific Telecommunity Standardization Program (ASTAP) and the International Organization for Standardization (ISO).

ITU has been vigorously setting standards for ITS's radiocommunications-related issues, which include:

- things relating to radiocommunications requirements
- things pertaining to ITS's necessary functions and technologies

- things relevant to the current use of frequencies
- things regarding communications volume and frequency bandwidths necessary for ITS.

Meanwhile, ASTAP has been supporting ITU, taking the responsibility of telecommunications standardization promotion in the Asia-Pacific region. ASTAP is a standardization organization formed under the Asia Pacific Telecommunity (APT) in November 1997, and has the in-house ITS Expert Group. At the ITS Expert Group Meeting, convened in January 1999 in Bangkok, Thailand, ASTAP compiled the outcome of the deliberations on VICS and ETC specifications into a draft, and then proposed it to ITU. ASTAP has been very active in proposing draft standards to ITU, representing the Asia-Pacific region.

ISO has been working on ITS standards since May 1993 at its Technical Committee 204/Transport Information and Control Systems (TICS), which deals with "standardization of information, communication and control systems in the field of urban and rural surface transportation." TC 204 has the following Working Groups, each of which has been formulating specifications for the field falling under its purview.

[Reference] WGs within TC 204

WG 1	System Architecture	WG 10	Traveler Information Systems
WG 1.3	Automatic Vehicle/Load Type Identification	WG 11	Route Guidance and Navigation Systems
WG 3	Referencing and Updating Procedure	WG 11.1	Route Guidance by Car-borne Navigation Systems
WG 5	Fee & Toll Collection/Management and Access Control	WG 11.3	Route Guidance by Central Control Unit
WG 6	General Fleet Management	WG 13	Human Factors and Human-Machine Interface
WG 7	Commercial/Freight Management	WG 14	Vehicle/Road Warning and Control Systems
WG 8	Public Transport/Emergency	WG 15	Dedicated Short-Range Communications (DSRC) for TICS Applications
WG 9	Integrated Transport Information, Management and Control	WG 16	Wide Area Communications/Protocol and Interfaces

2) Cooperation for and participation in the ITS World Congress

The ITS World Congress has been held since 1994 with the aim of promoting information exchanges as well as international collaboration on a global scale for achieving intelligent road traffic system. Japan has actively cooperated in the Congress activities.

ITS World Congress has discussed international collaboration schemes and made the latest research results public, aiming at full implementation of ITS at the earliest date. The Congress has been held annually with its venues being rotated between Europe, the U.S. and the Asia-Pacific region. The 1st World Congress on ITS was convened in Paris, France, in 1994, and Japan hosted the 2nd Congress in Yokohama in 1995. Last year, the 5th Congress was held in the Republic of Korea.

VERTIS serves as the liaison office for the ITS World Congress in the Asia-Pacific region. Therefore, Japan is expected to play a leading role in the international cooperation and association toward the worldwide promotion of ITS.

[Reference] The ITS World Congress in the past and future

- 1994 The 1st World Congress on ITS in Paris, France
  Theme: “Towards an Intelligent Transport System”
- 1995 The 2nd World Congress on ITS in Yokohama, Japan
  Theme: “Step Forward”
- 1996 The 3rd World Congress on ITS in Orlando, the U.S.
  Theme: “Intelligent Transportation: Realizing the Future”
- 1997 The 4th World Congress on ITS in Berlin, Germany
  Theme: “Mobility for Everybody”
- 1998 The 5th World Congress on ITS in Seoul, the Republic of Korea
  Theme: “Toward the New Horizon Together for Better Living with ITS”
- 1999 The 6th World Congress on ITS in Toronto, Canada (planned)
  November 8 through 1, 1999
- 2000 The 7th World Congress on ITS in Torino, Italy (planned)
- 2001 The 8th World Congress on ITS in Sydney, Australia (planned)

3. Measures implemented overseas

(1) Measures implemented in Europe

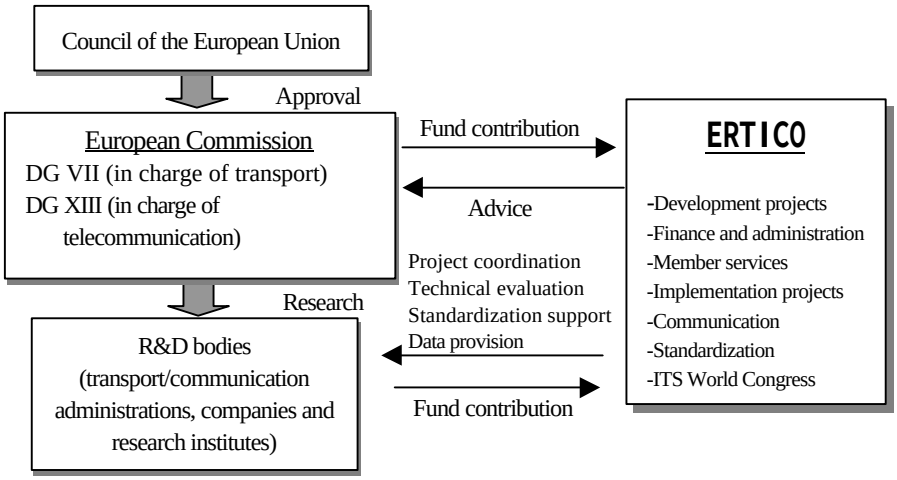
(a) Outline of measures and structure for ITS promotion

In Europe, ITS has been promoted on a project basis, while R&D work, pan-European standardization work and stronger market competitiveness are being vigorously pursued through collaboration of European countries.

The European Commission (EC) has led the ITS promotion in Europe as a public initiative in several phases. In those phased programs, EC has subsidized companies, universities and research institutes with their research expenses in order to promote ITS-related R&D and standardization activities in Europe. EC initiated TAP (Telematics Application Programme), an R&D program geared for the application of telecommunications technology. And T-TAP, which is part of TAP dealing with road traffic issues, has been approved as the next program following DRIVE II (Dedicated Road Infrastructure for Vehicle Safety in Europe) and is being implemented by Directorate-General XIII in charge of telecommunication as well as other Directorates-General of EC.

In 1991, ERTICO (European Road Transport Telematics Implementation Co-ordination Organisation) was established as the joint initiative of public and private sectors aimed at the T-TAP promotion. Funded by EC, ERTICO provides advice to EC as well as coordinates the project details with respective European countries' transport/communication administrations, businesses and research institutes for successful implementation of T-TAP.

Fig. 1-12 Structure for promoting ITS in Europe



(Source: "A Comparison of Intelligent Transportation Systems Progress around the World through 1996," by ITS America)

Fig. 1-13 ITS R&D programs in Europe

DRIVE I (1988～1994)

- Development of human-machine interfaces
- Development of traffic information systems using quasi-microwaves
- Development of various mobile communications services, etc.

DRIVE II (1992～1994)

- Route guidance field trials using GSM (Global System for Mobile Communications)
- R&D on automobile data communications technology
- Development of warning systems using inter-vehicle/roadside-vehicle communications, etc.

T-TAP (1996～1998)

- Development of an information platform for freight management
- Development of comprehensive information mechanism for ETC systems using DSRC
- Development of satellite navigation systems, etc.

PROMETHEUS (1986～1994)

- Development of AI (Artificial Intelligence) technology for car-mounted microprocessors
- Development of various sensors capable of realtime pattern recognition
- Development of data communications technology, on which PROMETHEUS systems depend
- Development of information systems such as inter-vehicle communications, electronic viewing and cruise-assistant information systems

(PROMETHEUS: Programme for a European Traffic with Highest Efficiency and Unprecedented Safety)

(b) R&D on ITS and their features

EC has been providing research funds to respective transport/communications administrations in European countries, as well as to businesses and research institutes (DRIVE and T-TAP). EU Member Countries have also been funding car manufacturers, universities and other organizations engaged in R&D activities (PROMETHEUS).

T-TAP comprises nine classified areas, under which a total of 70 projects are set up, for each budget has been allocated.

Prominent characteristics of measures implemented in Europe are as follows:

- Programs involve the entire process, from the beginning -- technological R&D -- to the end -- their standardization. For instance, in the activities for AREA 7-3 that deals with standardization, collaboration are sought from Comité Européen de Normalisation (CEN; European Committee for Standardization), the International Organization for Standardization (ISO) and other standard bodies to vigorously advance standardization.
- ITS development themes common to various areas have been chosen and are being promoted by interdisciplinary approach. These themes deal with user needs, evaluation, human-machine interface, needs of the elderly and disabled, traffic safety, among others.
- T-TAP is a program aimed to support development of various applications and is subsidizing a total of 70 different projects. The uniqueness of this program is that it is extending broad support to a number of projects, not to a very limited number of specific projects. This indicates European countries' viewpoint that development of a wide variety of applications is the key to successful ITS promotion.
- European countries have been promoting ITS, aiming also to enhance the European ITS industry's international competitiveness. EC conducts framework programs in order to advance European industries' science and technology base and, as a result, improve their international competitive power. T-TAP is part of such a framework program. EC's emphasis is on the support for technological R&D activities, before these are to be put under tough competition.

Fig. 1-14　Main T-TAP Development Areas

AREA1	Traveller Intermodality and Public Transport
AREA2	Freight Operations
AREA3	Road Transport Area 3-1 Driver Information Area 3-2 Automatis Debiting and Toll Collection Area 3-3 Network and Traffic Management Area 3-4 Vehicle Control
AREA4	Air Transport
AREA5	Railway Transport
AREA6	Maritime and Inland Waterways Transport
AREA7	Horizontal Activities Area 7-1 User Needs Area 7-2 Evaluation Area 7-3 Standardisation Area 7-4 Human-Machine Interface Area 7-5 Elderly and Disabled Needs Area 7-6 Traffic Safety
AREA8	Infrastructure and Common Services Area 8-1 System Architecture Area 8-2 Communications Technologies Area 8-3 Data Exchange Area 8-4 Digital Road Map Area 8-5 Satellite Navigation Area 8-6 System Safety
AREA9	Contribution to EU Policies Area 9-1 Demand Management Area 9-2 Integrated Demonstrations Area 9-3 Deployment Issue

(Source: Webpage of EC Directorate-General XIII at http://www.trentel.org/transport/framel.htm, and other sources)

(2) Measures implemented in the U.S.

(a) Outline of measures and structure for ITS promotion

In the U.S., ITS is regarded as holding the answer to today's transportation problems such as traffic congestion and traffic accidents, for which the population expects government actions. ITS has thus been promoted as a national project under the auspices of the U.S. President and the U.S. Congress. The Federal government (especially, the U.S. Department of Transportation [DOT]), states, private-sector organizations and universities are vigorously working together, following the top-down decisions.

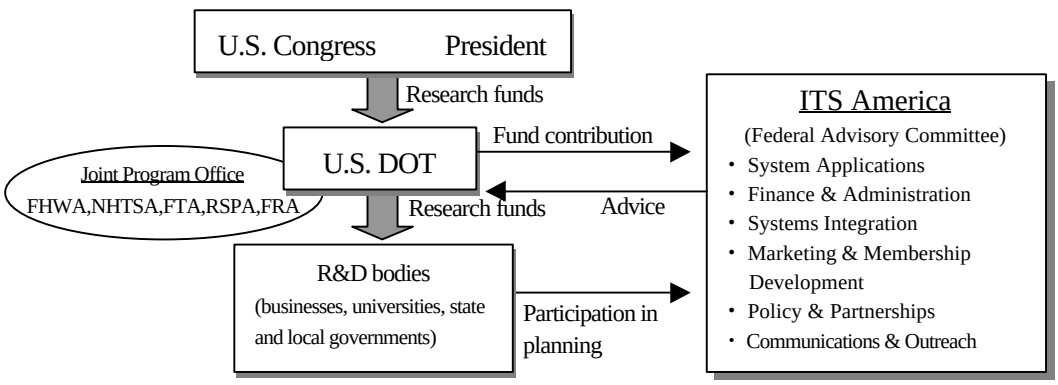
The U.S. government is also deeply involved in the process of ITS-technology standards setting, by funding those activities and extending other support. This is very rare for the U.S. government, which has observed its policy of letting the private-sector-led, free-market competition drive technological development and standardization moves. This indicates the country has very high hopes for ITS development and deployment.

DOT is playing a pivotal role in promoting ITS in the U.S. DOT established ITS Joint Program Office (JPO), which coordinates diversified ITS programs, and has sought collaboration of relevant administrations, including the Federal Highway Administration (FHWA), National Highway Traffic Safety Administration (NHTSA), Federal Transit Administration (FTA), Research and Special Programs Administration (RSPA) and Federal Railroad Administration (FRA).

Meanwhile, ITS America, a private ITS promotional organization, was officially made a Federal Advisory Committee to DOT in September 1994. ITS America has a membership of more than 1,200 entities today and is cooperating with the U.S. Congress, local governments, businesses and academic circles. ITS America is a nonprofit scientific and educational organization, aimed at coordinating and promoting the development, deployment, integration and acceptance of intelligent transportation technologies in the U.S.

ITS America has dealt with ITS deployment from a global viewpoint. In 1994, ITS America compiled and submitted a report entitled "A Comparison of Intelligent Transportation System Progress in Japan, the U.S. and Europe (??)" to the U.S. Congress, which covered the three regions being successful in ITS development ahead of other regions. In 1997, the organization issued the second edition of the report. These reports have an extensive coverage of issues regarding the ITS development and have received high evaluation from people engaged in ITS development.

Fig. 1-15 Structure for promoting ITS in the U.S.



(b) Effects of ITS introduction into the U.S.

Research institutes and other organizations have estimated in numbers the effects of ITS introduction into the U.S.

■Capacity

- Road capacity would increase by 35% by constructing the ITS infrastructure in metropolitan areas nationwide.
- Introduction of the ITS infrastructure into 75 American cities would push up investment returns by 8.8 times.

■Safety

- Introduction of on-board collision avoidance device could reduce the number of traffic accidents by 17%.

■Cost savings

- Vehicle operation management, ETC, travelers information systems and so on could enable a cost reduction of 4 to 7 billion U.S. dollars in the next decade.

(c) Standardization and human resource development

U.S. DOT sees ITS as the unity of technologies, systems and traffic management geared to achieving improved safety and efficiency in the surface transportation system. DOT thus defines ITS as not a single system but the "system of systems." Meanwhile, the U.S. Congress ordered DOT to ensure interoperability of ITS throughout the country, so as to set national standards and give the burgeoning ITS industry ample business chances.

In addition, DOT has put a special emphasis on training of ITS experts as a government office. DOT predicts the urgent need for technical ability of staff to procure, deploy, operate and maintain ITS in the near future, and is vigorously training people to turn them experts on standardization, information technology, systems integration and other related areas.

(d) ITS-related laws and budgets

After the enforcement of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), a gigantic amount of money -- approximately 1.29 billion dollars -- was spent for ITS promotion in the past five years (about 154.8 billion yen, on the 1 dollar = 120 yen exchange rate). Raised through a top-down scheme, the money comprised of the budget earmarked by the Act as well as a portion of DOT's general budget and was poured into for R&D, architecture construction and standardization activities.

In June 1998, President Clinton signed the Transportation Equity Act for the 21st century (TEA-21), the

follower of the ISTEA. TEA-21 has set a total budget of about 1.28 billion dollars (153.6 billion yen) for the fiscal 1998 to 2003 span, to be spent for further development and deployment of ITS on the issues involving the surface transportation system.

Fig. 1-16 ITS budget secured by TEA-21

(Unit: million dollars)

	1998	1999	2000	2001	2002	2003	Total
ITS Research and Development	95	95	98.2	100	105	110	603.2
ITS Deployment	101	105	113	118	120	122	679.0
Total	196	200	211.2	218	225	232	1,282.2

(e) User services in the U.S.

Expected user-oriented services upon realization of ITS have been thought about in the U.S. as well. As shown in Fig. 1-17, a total of 30 user services are defined under six classified areas.

Fig. 1-17　30 user services planned in the U.S.

Travel and Traffic Management 1. Pre Trip Travel Information 2. En Route Driver Information 3. Traveler Services Information 4. Route Guidance 5. Ride Matching and Reservation 6. Incident Management 7. Travel Demand Management 8. Traffic Control 9. Emissions Testing and Mitigation 10. High-way-Rail intersection
Commercial Vehicle Operations 11. Commercial Vehicle Electronic Clearance 12. Automated Roadside Safety Inspection 13. Commercial Vehicle Administrative Processes 14. On-Board Safety Monitoring 15. Commercial Fleet Management 16. Hazardous Material Incident Notification
Public transportation Management 17. En Route Transit Information 18. Public Transportation Management 19. Personalized Public Transit 20. Public Travel Security
Electronic Payment 21. Electronic Payment Services
Emergency Management 22. Emergency Vehicle Management 23. Emergency Notification and Personal Safety
Advanced Vehicle Safety Systems 24. Longitudinal Collision Avoidance 25. Lateral Collision Avoidance 26. Intersection Collision Avoidance 27. Vision Enhancement for Crash Avoidance 28. Safety Readiness 29. Pre-Crash Restraint Deployment 30. Automated Vehicle Operations

(3) Measures implemented in the Asia-Pacific region

(a) Current situation in the region

Many countries in the region are facing worsening transportation problems, as more people move into urban cities and more automobiles are sold at a fast pace in line with the regional economic growth. Since this region comprises countries of diversified cultural and geographical backgrounds, and thus the situations vary as to their population, landscape as well as the development of roads, public transport system and information infrastructure, it is necessary to come up with the solutions best meeting the situations of each country.

(b) Measures implemented by respective countries (including areas)

The status of ITS promotion in the region largely differs from one country to another.

ITS has been vigorously introduced in some parts of the region. For instance, the Republic of Korea, Malaysia, Singapore, Thailand, Hong Kong and Taiwan are introducing ETC, while Indonesia, Australia and Thailand have already put advanced transportation control systems into operation. In particular, the ROK and Malaysia have set up an extensive national scheme geared to ITS promotion.

On the other hand, developing countries in the region have just begun research on ITS, following far behind of the other group of countries in ITS development and introduction process. Because road traffic problems emerge as the economy grows, it is expected that such developing countries will need to introduce ITS in developing their road/transportation infrastructure in the near future. For this reason, strong and unified international cooperation and collaboration is a must for promotion of ITS in the Asia-Pacific region.

In this regard, as the representative of this region, the Vehicle, Road and Traffic Intelligence Society (VERTIS) has taken the responsibility of dispatching the regional information and coordinating details for ITS World Congress as well as ITS seminars in the Asia-Pacific region. High expectation is placed on VERTIS for the organization to further strengthen mutual ties with other countries' ITS promotional bodies, while maintaining the trust given by countries overseas, and to play a crucial role in further promoting ITS in the Asia-Pacific region.

In January 1999, the Asia-Pacific Telecommunity [APT] Standardization Program (ASTAP), the promoter of telecommunications standards setting in the region, held its ITS Expert Group Meeting in Bangkok (countries participated: Indonesia, Japan, Laos, Malaysia, Mongolia, the Philippines, Sri Lanka and Thailand). The Group agreed upon the following items concerning the situation of ITS promotion and standardization in the region, and determined to further cooperation among the countries in the region.

■Traffic congestion in urban cities of countries in the Asia-Pacific region has not been eased much.

■ITS holds the answer to traffic congestion in urban cities of the region.

■ETC is the most eagerly awaited among ITS applications for introduction。

■International cooperation in this region is very important for the regional success of ITS, since the region holds about 20% of automobiles worldwide.

■In order to succeed in ITS development and deployment, each country in the region needs to establish a system that effectively coordinate several governmental administrations, each charged with different responsibilities for ITS promotion.