

INTELLIGENT TRANSPORT SYSTEMS



Intelligence at the service of
transport networks

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The European Commission's Energy and Transport DG develops and carries out EU policy in these closely linked areas. The 2001 White Paper, '**European transport policy for 2010: time to decide**' sets out 60 practical measures designed to bring about significant improvements in the quality and efficiency of transport in Europe by 2010, and to break the link between economic growth and growth in the demands on transport systems.

Published by: European Commission, Energy and Transport DG
B-1049 Brussels
http://europa.eu.int/comm/dgs/energy_transport/index_en.html

Luxembourg: Office for Official Publications of the European Communities, 2003.
ISBN 92-894-4786-9

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Text completed on 16-05-2003.

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Printed in Belgium

INTRODUCTION

Intelligent transport systems (ITS) use information and communications technologies to facilitate the seamless transport of people and goods. Their successful development and application could hold the key to solving many of our transportation problems, reducing health and environmental impacts, increasing economic efficiency and saving lives. The potential of ITS to provide solutions for 21st century European transport is recognised in the European Commission's White Paper on '*European transport policy for 2010 – time to decide*'.

While many aspects of society have been improved by the introduction of advanced technologies, we have remained content with a transport system whose primary controlling technology is the traffic signal, largely unchanged since its invention in 1923. In confronting the question of improving the European transport system, three main issues must be addressed.

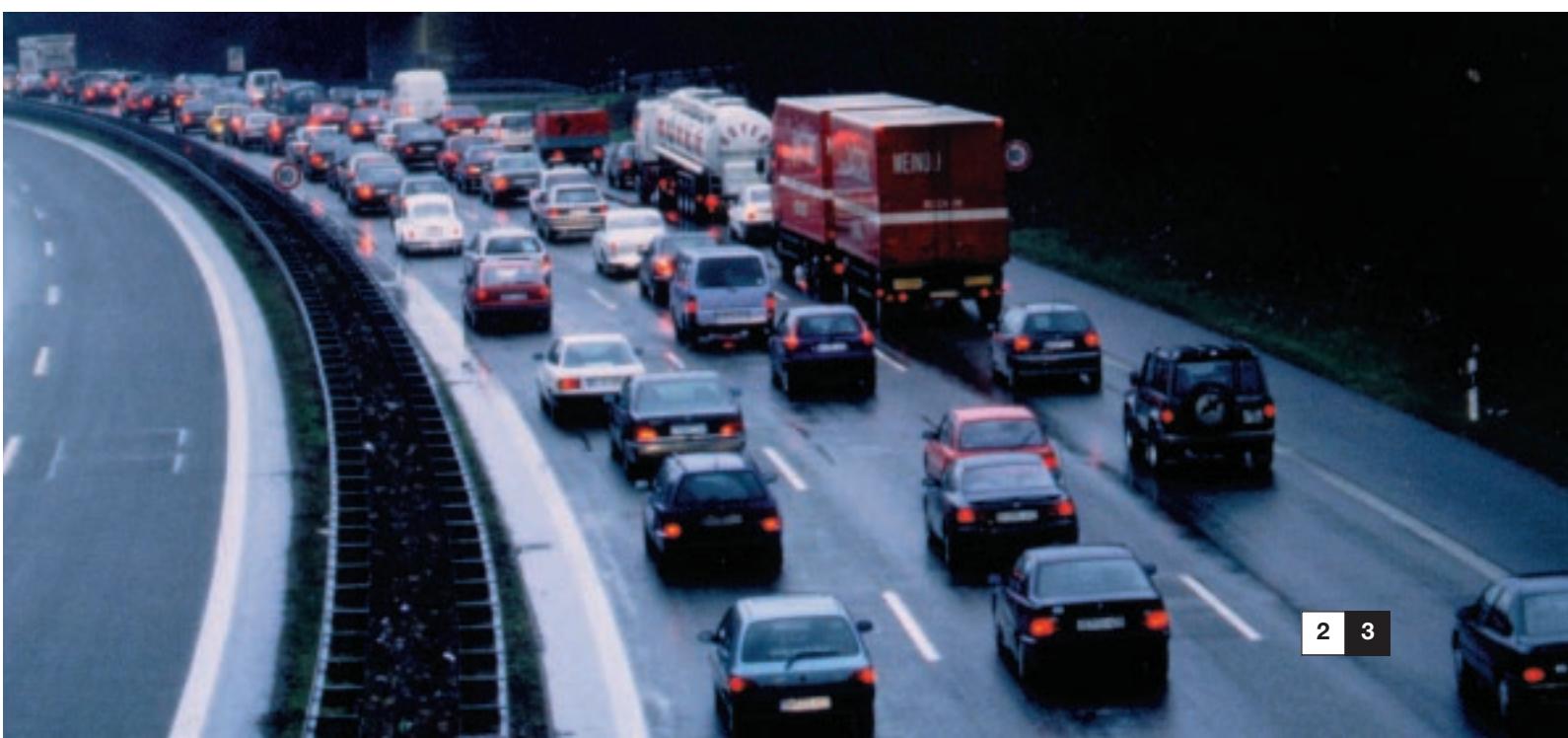
- Congestion – Bottlenecks on the main international routes remain a major problem, while urban and inter-city congestion requires immediate action.
- Pollution and health – The emission of harmful gases is now widely recognised as a real danger for the future of mankind. Breathing problems are on the increase in urban areas, while, in a world where travel is a daily necessity, increasing traffic congestion is making life more and more stressful.

- Safety – Road transport is by far the most costly mode in terms of safety, claiming 40 000 lives every year in Europe.

Managing mobility

The wide variety of ITS applications now being put forward represent a real opportunity to move towards a better future, but they are anything but futuristic. Real ITS systems, products and services are at work today throughout Europe, based on telecommunications, electronics and information technologies. Nevertheless, the wide-scale development and deployment of these applications represents a true revolution in transportation.

The trans-European networks, the framework programmes for research and development, and specific programmes like the GALILEO satellite navigation system represent powerful tools at our disposal, but it is essential that the best use be made of existing infrastructure as well. This includes the huge number of high-quality road and rail routes, seaports, airports and inland waterways.



European transport policy and TEN-T

The potential of ITS applications has encouraged the European Union (EU) to refer to them specifically in the transport White Paper, identifying the alleviation of traffic congestion and bottlenecks as a priority for the next 10 years and citing the use of ITS as a means to that end. Taking this a step further, the EU is also aiming to facilitate the deployment of ITS and create a single market for ITS services. This includes the timely development of technical standards that ensure interoperability and would provide a stable basis for investment decisions, as well as the setting-up of the necessary legal framework for the deployment of ITS services.

In the wake of several research and technological development programmes, the Community guidelines for the development of the trans-European network for transport (TEN-T) marked the start of a

series of Community measures and actions aimed at promoting the use of information technologies throughout the transport system. The TEN-T guidelines cover, among other things, the telematics infrastructure for traffic management systems and traffic information services.

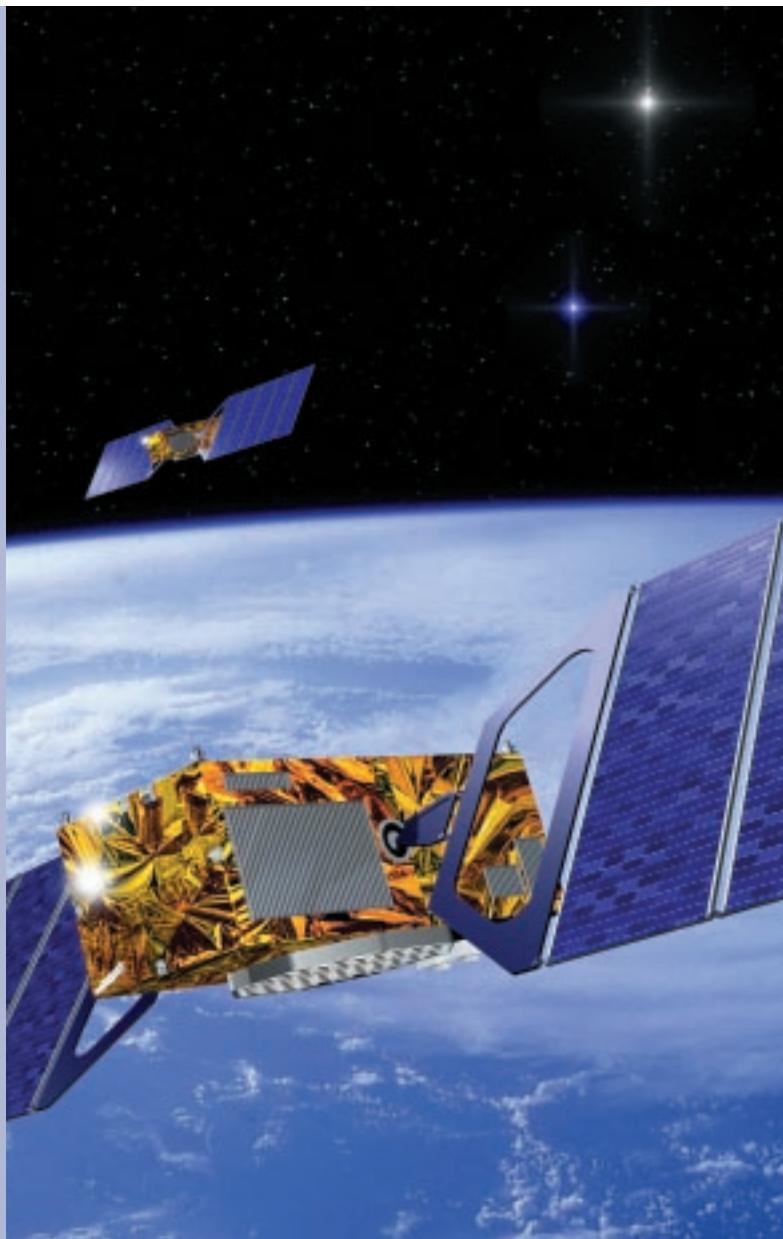
While advanced road traffic management systems have already been implemented in many places throughout Europe, regional and national ITS services still form a fragmented patchwork. Based on a wide vision of ITS deployment throughout Europe, the TEN-T will establish interconnections, interoperability and continuity between services on long-distance routes, in metropolitan areas and across borders.

Satellite navigation

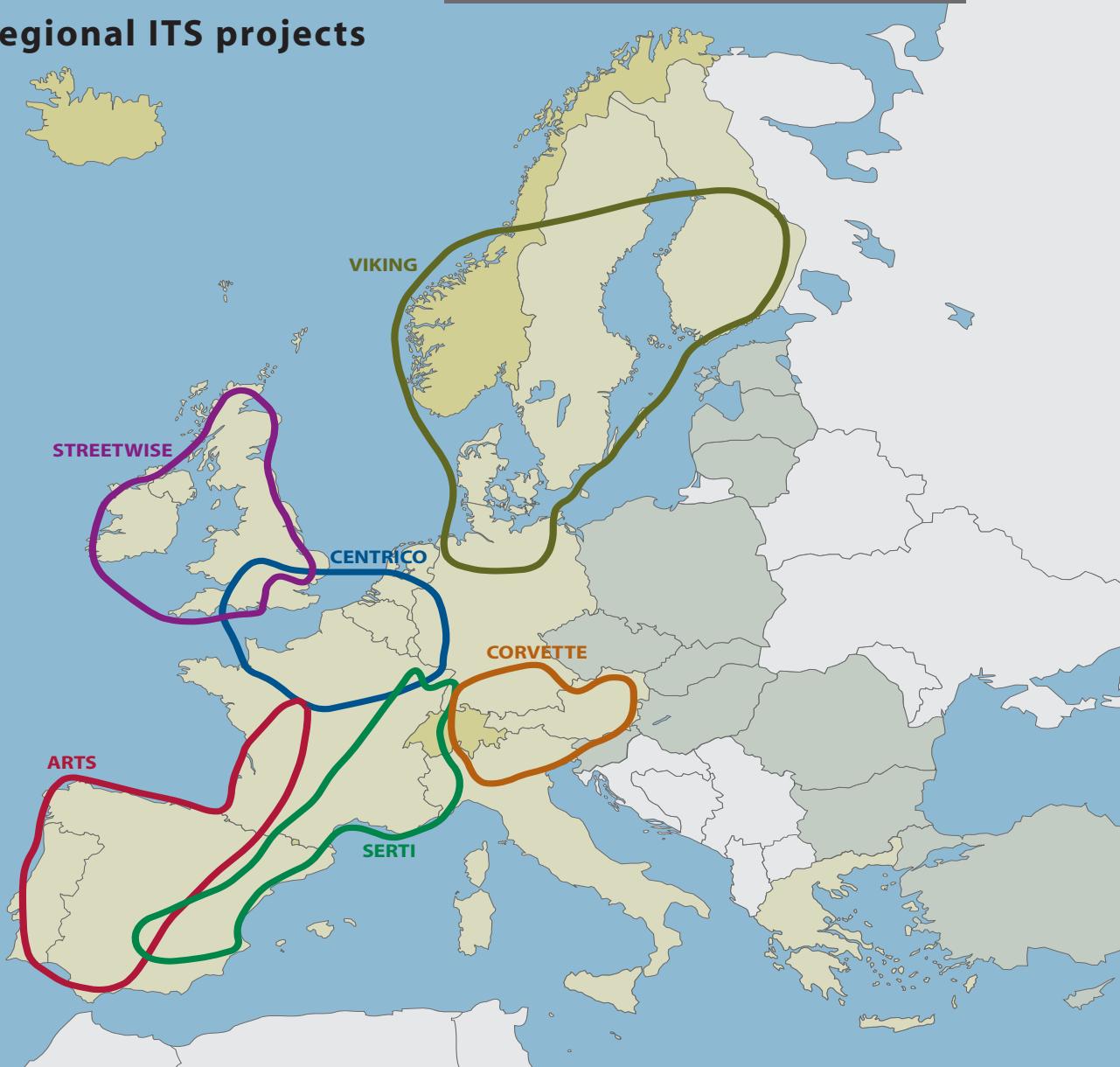
The European system for satellite navigation and location, GALILEO, will be operational from 2008. Its precursor, EGNOS, will already offer enhanced navigation services as from 2004. GALILEO will provide a wide range of improved and more reliable services to users over the entire surface of the earth. Several types of services will be provided, ranging from general-purpose, free-of-charge services to services aimed at specific groups, including emergency services and governmental users. Compared with the existing American GPS system, GALILEO will feature:

- a higher degree of precision, better reliability and more homogeneous coverage (95 % of all urban areas covered at all times without interruption, compared with 50 % today);
- a guaranteed level of quality and continuity of service, making satellite navigation available for safety-critical applications such as train control or critical flight phases in aviation.

GALILEO will contribute to the development of a wide range of applications and services covering many economic activities and all segments of society. All transport modes that can make use of precise traveller-location information will be concerned, notably for safety-related purposes as in the aviation and maritime sectors. Road applications will include, among other things, in-car navigation, electronic fee collection, fleet management and driver assistance, while the rail community will benefit from improved track survey and passenger information services.



Euroregional ITS projects



ITS by and for Europe

The Commission has already launched a series of projects across the European Union aimed at solving transport problems in particular regions. These 'Euroregional' TEN-T network initiatives focus on specific ITS issues, including improving traffic management systems, providing traveller information before and during trips, and road safety and emergency handling. The map above shows the European regions and corridors where studies and ITS implementations are being supported by the Commission.

The unprecedented enlargement set to take place over the next few years will give the European Union a truly continental dimension. The first challenge will be to connect the new Member States to the trans-European transport networks, a precondition for their full economic integration and development. This task will be aided considerably through extensive use of intelligent transport systems and services.

This brochure provides an introduction to the extensive potential that intelligent transport systems can offer to the transport services available on all European transport networks. This potential has been, and is continuing to be, realised as a result of European Commission programmes for the implementation of ITS on the trans-European transport networks and through the framework programmes for research and development. The future development of the trans-European transport networks will take forward the services to travellers and for the movement of freight that are currently emerging from ITS research to full implementation.



TRAVEL INFORMATION AND PLANNING

Mobility has become a major issue in the lives of most European citizens. Congestion is now estimated to be costing the European Union EUR 40 billion a year, and it has been known to take over four hours to travel 5 kilometres in some cities during rush hour. While most traffic problems are local in nature, many can be addressed at the European level, especially those involving longer journeys. The benefits of ITS deployment from the user's point are threefold: improved road safety, maximised road network efficiency and reduced environmental impact.

It's a traveller's life

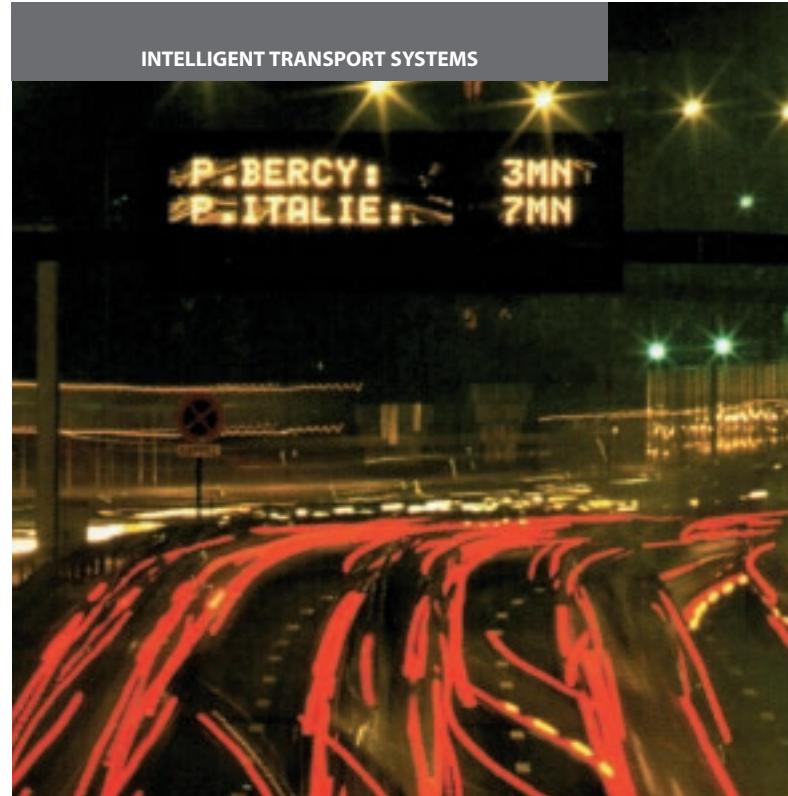
ITS can provide road travellers with up-to-the-minute information and forecasts concerning traffic and weather conditions, helping people plan their trips more efficiently before they leave their homes. Once en route, real-time information services can warn travellers of traffic delays, incidents or accidents, with guidance systems helping people to choose alternative or optimised routes. Traffic information broadcasts are now available in drivers' own languages via standardised on-board radio sets operating on radio data system-traffic message channels (RDS-TMC). Journey-time predictions are often available to facilitate route choice. Increasingly, traffic operators are deploying radio broadcast

systems and variable message signs on their networks in order to inform, in real time, travellers who are not equipped with specific ITS devices. Parking availability information can help travellers to reach their final destinations more easily, and, in urban areas, pre-trip and on-trip data can provide information on public transport systems, itineraries, departure and arrival times, and expected waiting times at bus and metro stops. Such information can also be accessed via the Internet or GSM.

It is also becoming easier to obtain travel information in the vehicle itself. In-vehicle/on-board information can be delivered via traditional radio stations, frequencies reserved for specialised road information services, RDS-TMC, digital audio broadcast (DAB), GSM, and, increasingly, in combination with navigation satellite system data. The driver may need an appropriately tuned telematics system and perhaps an associated subscription to receive real-time traffic updates, route-guidance information and even point-of-interest data such as the location of nearby hotels, restaurants, petrol stations or museums. The market for accurate real-time information is growing and location-based services, which can vary from keeping track of freight to advising passengers when the next bus will arrive, are set to multiply rapidly in the next decade. These services will be even more powerful once GALILEO is up and running.

The citizen benefits

Better information and improved traffic flow will make journey times more predictable, reducing stress for drivers and allowing for better coordination between travellers and those awaiting their arrival. Reduced congestion will also mean more efficient use of fuel, reducing operating costs and harmful emissions. ITS can also provide advanced warning of road accidents and other incidents on variable message signs, enabling drivers to slow down before they reach stationary traffic, reducing the number of secondary accidents.



SERTI – Cross-border information on the Mediterranean coast

For some years, French motorway companies have maintained an Internet website providing real-time traffic information for most stretches of their roads. This information includes travel-time predictions on some important parts of the network. As part of the SERTI Euroregional project, a specific action, to be launched in 2003, will extend this website to cover the motorways of Catalonia and the Italian Riviera, as a first step towards a general cross-border information service based around the Gulf of Lions. Near the border between Nice and Genoa, for example, important information regarding both sides of the border will be delivered via variable message signs and radio broadcasts by the relevant road operators, ESCOTA in France and Autostrada dei Fiori in Italy.

CENTRICO – Cross-channel information services

Cross-channel traffic has grown significantly in recent years. The CENTRICO project aims to provide travel information services to customers crossing the English Channel. These services contribute to efficient long-distance travel through cross-border data exchange and traffic management. The project will improve cross channel information services by:

- *making best use of existing infrastructure to provide early services;*
- *providing the data needed for emerging information services;*
- *developing long-term solutions using new technologies;*
- *evaluating traveller reception, the effect on service expectations and future requirements for integrated services.*

VIKING – Traveller information services in northern Europe

The VIKING Euroregional project is developing an information system, NEMIS, (Northern Europe mobility information services) to provide road users with information on alternative travel arrangements, in particular: time, travel delays and costs as well as journey comfort and quality.

NEMIS encompasses the whole traffic system and is based on national mobility and travel-planning systems, linking together existing systems and enhancing cross-border links in northern Europe. NEMIS is one step on the path towards a pan-European traveller information service becoming available via the Internet.



TRAFFIC MANAGEMENT

Traffic volumes in most areas are growing faster than transport budgets, making road travel tedious, frustrating and highly inefficient. Today in London, for example, traffic on some key roads has slowed to an average of under 3 kilometres per hour. As governments are struggling with the demands being placed on infrastructures, residents and businesses, the lack of physical space to expand or build new highways has rendered many alternatives obsolete. Transport providers are also contending with slashed budgets while straining to meet greater expectations from customers. ITS is critical to ensuring the long-term economic prosperity of our urban and suburban areas, pointing to a new paradigm of managing intermodal transportation as a single system.

CORVETTE – Cross-border co-operation in the Alps

Crossing the Alps from north to south, and vice versa, is a major undertaking, especially for vehicles carrying heavy goods. A variety of corridors can be used to get from Germany to Italy and back again, but recent tunnel accidents have led to major detours, road closures and reduced route options. Like the SERTI project along the Riviera, the Community-funded CORVETTE project is developing co-operative arrangements between road operators in different countries, collecting and exchanging information and helping travellers choose the best options, including along the Karawanken corridor linking Slovenia and Austria.

ARTS – Continuous telematics service

The ARTS project, launched under TEN-T in 1997, represents the first attempt by public traffic administrations in Spain, France and Portugal to coordinate traffic telematics projects at regional, bilateral and multilateral levels. The final objective is the total removal of borders for traffic purposes, improving the continuity and quality of services to be offered to road users. The goal is that road users should not feel the difference when passing from one country to the next, implying continuity of services and interoperability.

What are the solutions?

One of the main goals of ITS is the optimisation of the transport system, similar to what the aviation industry has done by better managing airspace. That industry has grown substantially in recent years, without having to build new airports. ITS provides both road and public transport operators with more accurate and on-time information on the situation on their networks, making it easier to inform travellers and provide alternative solutions.

Some concrete examples are:

- traffic-signal control systems in cities that automatically adjust themselves to optimise traffic flow, giving right of way to public transport;
- highway management systems providing information to motorists, recommending optimum speed for instance, thus increasing capacity and flow, and minimising congestion due to accidents;
- GALILEO-based locating devices and equipment-monitoring systems for transport fleets;
- electronic toll collection, providing drivers with convenient and reliable automated transactions, improving traffic flow at toll plazas;
- electronic fee payment enabling a person to pay for parking, bus and train fares as well as tolls, with a single smart card;
- railway level crossings coordinated with traffic signals and train movements;
- regional multimodal information systems that provide road and transit information to travellers.

The benefits of integrated traffic management are well documented through actual testing and operations. They include measurable congestion reduction and reduced crash rates, better relationships among service providers and a stronger economy through increased mobility and accessibility to new markets.

IMPROVING TRANSPORTATION FOR THE ELDERLY AND PEOPLE WITH DISABILITIES

The population of elderly people is growing steadily and the number of elderly travellers and those with disabilities is set to increase substantially over the next 20 years. With modern travel often difficult for people who are able-bodied, one can only imagine the kinds of problems facing people with physical limitations. The elderly and people with disabilities therefore form a significant part of the market for ITS services and equipment.

Improving accessibility

ITS has the potential to improve the accessibility and efficiency of public transport by the provision of pre-trip information and of real-time information during a journey. The use of 'smart' payment cards and cards that provide details of traveller requirements to operators will help to reduce barriers to all travellers, especially those with physical disadvantages. The EU-funded ADEPT II project has been instrumental in addressing many of the pre-implementation issues associated with the deployment of smart cards and other ITS technologies in the field of payment, information systems and demand management in the transport sector. The main sites in the project include Gothenburg, Thessaloniki and six sites in Finland, each deploying a combination of smart cards with transponders, and also smart cards alone, as a payment and access mechanism.



Talking signposts, audio announcements from visual displays and hand-held location and guidance systems could help pedestrians and passengers with visual impairments. GALILEO promises the advent of practical, affordable technological solutions aimed at assisting people with disabilities in a variety of situations.

People with reduced mobility

People with reduced mobility (PRM) represent an important proportion of the EU population (about 35 to 40 %). They principally comprise people with disabilities and the elderly but also include people with luggage or shopping bags, people with young children and people with temporary injuries. Whatever the specific application, making existing services and systems easier to use by PRM will also make them easier to use by the general public. Ergonomic and ease-of-use evaluations have become a basic element in the design of ITS applications.

Examples of GALILEO applications for people with disabilities

- Personal navigation assistance for people with impaired vision
- Monitoring of movements of Alzheimer's sufferers with memory loss
- Route planning for people with physical impairment
- Enhancement of telemedicine or emergency services through real-time localisation
- Real-time public transport audio announcements on remaining travel time, next stop and connections

FREIGHT AND FLEET MANAGEMENT

ITS vehicle-tracking systems are being adopted widely by commercial fleet operators, such as delivery companies and public transport providers, as a means of streamlining mobile operations. By equipping all fleet vehicles with a location device that broadcasts positions to a control centre, managers can optimise fleet deployment, saving time and money and improving customer service. ITS will also greatly assist in the 'modal shift' of freight from road to rail, as proposed in the transport White Paper.

The fundamental objectives of improving freight and fleet management are:

- reduction of trips made with empty or sparsely loaded cargo/passenger holds;
- optimising the distance travelled, so as to minimise the impact of vehicles on traffic flow and the environment;
- incident management programmes that enable response to accidents or breakdowns with the best and quickest type of emergency services, minimising clean-up and medical response time.

A range of applications

Many tracking systems can feed information back to drivers via an in-vehicle telematics display, enabling dynamic course adjustment and en route pick-up/delivery changes. In addition, stolen vehicles equipped with tracking devices can usually be located. One award-winning system, for example, has allowed police to recover such vehicles.

Other ITS devices are being developed aimed at simplifying international goods transportation. The digital tachograph, for example, will become a required feature of all new European commercial vehicles in 2003. This device will allow the rapid verification of such vehicle statistics as origin and destination, goods being transported, distance travelled, time en route and so forth. This will, in turn, allow authorities to verify compliance with regional and international regulations without disrupting the flow of goods and services.



Public transport

Public transport applications can provide for an overall improvement in the safety, efficiency and quality of delivered services. We have all seen buses or trams stacked up one behind the other in traffic, the first vehicle jam-packed with frustrated passengers while the rest are empty. A simple solution, giving right of way to public transport at traffic signals, can cure the 'bus stack' syndrome, keeping public transport vehicles evenly spaced and on time. ITS can also allow operators to know exactly where their vehicles are and to manage their fleets more efficiently, and to issue orders to drivers to speed up or slow down. Passengers can also be informed of expected waiting times.

Fleet management is a complex yet crucial task for bus and train operators. Knowing the exact location of their vehicles, operators can inform travellers of expected arrival time. In some cities, electronic displays now provide this information at bus and metro stops. In Europe, more than 500 000 vehicles, including many taxis, have been equipped with transmitters that can communicate their location to a control centre. The GALILEO satellite navigation system, once in place, will guarantee continuous uninterrupted service of this type.

STREETWISE – Seamless travel information services

While individual countries have historically evolved their own travel information systems, co-operation across borders requires a more synchronised approach. With regard to freight and fleet management, the Community-funded STREETWISE project's objectives include:

- *intermodal transfer of freight;*
- *pre-trip planning of ferry crossings and routeing to avoid congestion;*
- *monitoring journey-time reliability across networks;*
- *re-routeing of vehicles to avoid poor weather conditions and improve safety.*

ELECTRONIC FEE COLLECTION

E

lectronic fee collection (EFC) can save road travellers time and frustration, allowing them to drive non-stop through tolling areas.

Under the current system already in use in many areas, as a car passes through a toll point a roadside antenna reads a small electronic transponder on the inside of the car's windscreen. Vehicles are billed automatically as they pass through the tolling area, improving throughput and minimising delays. The underlying technology is known as dedicated short range communications (DSRC). Today's systems will evolve over the coming years into a universally accepted European system using satellite navigation (e.g. GALILEO) as a better means of collecting tolls and fees.

Multiple applications

Electronic fee collection has been seen as an effective way to finance new infrastructure and improve traffic flow and its use has expanded enormously worldwide in just a few years, especially in countries and regions with large numbers of toll roads and bridges. New charging policies that discriminate between cars, trucks and other kinds of vehicle are now being put in place with the aim of reducing traffic congestion at certain times of the day or limiting access to town centres. The basic principle that 'users have to pay the real cost of transport' has led to kilometre-charging



systems, applied first in Switzerland in 2000, and then in Germany and Austria in 2003. Such systems are also being used in the public transport domain to simplify ticket purchasing and increase passenger throughput. A quick 'swipe' of the appropriate smart card in Paris, for example, and users can access the metro, trains and buses, as well as pay for purchases at certain shops.

Functional and contractual interoperability

Future EFC systems will be based on satellite location (e.g. GALILEO) and mobile telephone technology (GSM). These technologies represent the most efficient tools for the deployment of new charging policies. Moving towards interoperability will mean defining a common European EFC service, including a minimum level of functionality to enable authorised subscribers to pay fees using the same method of payment and the same equipment anywhere in Europe. The existence of interoperable equipment also implies the necessity for contractual interoperability, meaning common contractual agreements between infrastructure operators. The aim of the European Commission is to deploy this service in 2005 for trucks and coaches.

CESARE – Interoperable non-stop tolling concepts

The EU-funded CESARE project is aimed at developing and implementing a common interoperable electronic fee collection system, including contractual, procedural and technical arrangements. The objective is to allow European users to travel throughout the transport network, paying tolls automatically with the help of on-board ITS systems. The CESARE project is the first attempt to set up the future Europe-wide electronic fee collection system.



TRANSPORT SAFETY

The number of road accident victims is spectacularly high in the European Union, with around 40 000 fatalities and 1.3 million injuries being recorded each year. Young people aged 15 to 24 are most at risk, with a fatality rate which is 50 to 90 % higher than that of the population as a whole. Pedestrians, cyclists and motorcyclists are not immune either, accounting for 40 % of all road deaths in the Member States in 1994. Faced with this dreadful state of affairs, the European Commission's road safety action plan is aimed at improving road safety within the EU.

While the human costs of road accidents are obviously tragic, the economic costs are also considerable. Meeting Europe's goals for safety has been a major driving force behind the development of ITS.

Applications

The Commission is actively exploring a number of attractive safety-related ITS applications. The digital tachograph, for example, records all of a vehicle's activities, including distance, speed, driving times and drivers' rest periods. Passive assistance systems inform drivers about potential problems. For example, an in-vehicle navigation system might emit a warning to decrease speed for an upcoming curve. An active assistance system, on the other hand, could actually slow the vehicle down. Other driver-assistance systems include vision enhancement, collision avoidance and automatic emergency notification.

Intelligent speed adaptation

Most road accidents in Europe happen in built-up areas, with excessive speed as one of the main causal factors. Often drivers are simply unaware of the speed limit or of their own speed while driving. In the city of Umeå in northern Sweden, a simple in-car device is helping drivers to change their behaviour, alerting them when they exceed the speed limit. The 'intelligent speed adaptation' device receives a signal from a beacon mounted on a roadside speed-limit sign near schools and other sensitive areas. The system checks the vehicle speed against the actual speed limit and, if necessary, warns the driver to slow down. The unit eliminates the need for speed humps or other physical measures, which are expensive and an obstacle to emergency vehicles and buses. Tests have shown that drivers appreciate the service, with 90 % of them wishing to see it extended to other areas of the city.

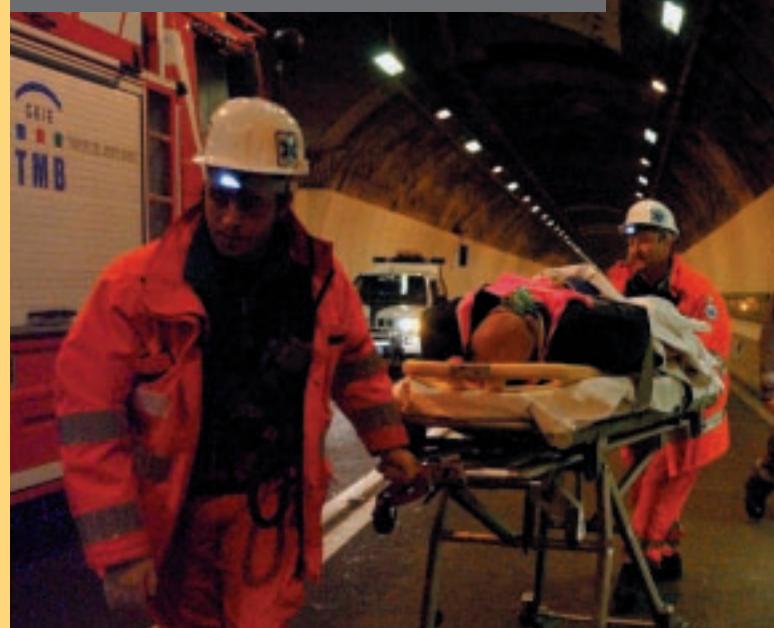
Driver monitoring

Dangerous driving is the cause of most traffic accidents. ITS systems that monitor the behaviour of vehicles and drivers can have an enormously positive impact. Voluntary systems for generating driving reports can provide important information to help drivers operate their vehicles more safely. Insurance companies are beginning to provide insurance based on actual distance travelled, charging customers on the basis of real-time observations using satellite location and positioning and GSM technologies. Such technologies, which will be enhanced once GALILEO is operational, provide motorists with more accurate insurance rates based on actual use of their cars and the relative safeness of their driving behaviour.



Fréjus – Training for tunnel safety

Efficient emergency handling in road and rail tunnels is becoming more and more critical as traffic flow increases, especially that of heavy freight and vehicles containing dangerous materials. SFTRF, one of the two operators of the Fréjus Tunnel between France and Italy, has developed a training centre for rescue teams based on real-life simulations of accident conditions in a tunnel environment where every second counts. Using state-of-the-art computer systems and the most recent technologies, the centre runs various exercises, providing emergency staff with invaluable hands-on experience. Simulations include highly stressful conditions of fire, thick smoke, explosions and human distress.



EMERGENCY AND INCIDENT HANDLING

Rapid response to emergencies is a critical requirement not only for saving lives and aiding the injured but also for the removal of obstructions and the maintenance of efficient traffic flow. Some domestic vehicles are now being equipped with automatic crash sensors and positioning systems that can communicate directly with emergency dispatch centres. Such systems require no action on the part of the driver, communicating a vehicle's exact location even if he or she is incapacitated. In the absence of a central control station, emergency vehicles can be equipped with independent tracking systems enabling precision resource deployment. GALILEO will enhance the capabilities of such systems significantly, even allowing the specification of the lane in which an incident has occurred.

The response time for emergency services to reach the scene of an accident varies greatly. Currently the response depends on user contact by telephone or on infrastructure-based sensing equipment. In the case of mobile calls, the location of the accident or incident cannot be accurately determined in 40 % of the cases. The Commission has acted to improve this poor situation through an initiative that enhances the 112 emergency call number service by making the transfer of location data to the emergency services a mandatory action for mobile phone operators from June 2003*. From this date, they will have to provide the best possible caller location information that will reduce response time, reduce trauma in victims, increase survivability and provide the opportunity for enhancing the complete incident and road emergency management chain. Over time, the best

possible caller location will progressively be provided by satellite location and positioning available from GALILEO.

In the future, such systems are expected to be of help in the management of dangerous materials transport. In the event of an accident, an on-board terminal will transmit not only the accurate location of the vehicle, but also specific information on vehicle contents, including the amount and kind of material being carried.

In-vehicle sensors can also be useful in the event of a breakdown, allowing repair crews to arrive quickly and prepared to deal with the specific problem at hand. It is expected that vehicles will one day be able to conduct self-diagnosis and alert a mechanic automatically should a problem be discovered, or even before it appears. Similar systems can be applied to pedestrian travellers, with GSM-based devices alerting emergency assistance providers to the precise location and condition of individuals in distress, whether due to an accident, a medical situation, or perhaps as a result of a crime.

The socio-economic benefits of incident management are estimated at about EUR 50 million a year in Europe alone, arising from faster medical assistance and reduced traffic jams. Precise information from GALILEO on the location of accident sites together with fast communication links will reduce the reaction time and increase the efficiency of incident management teams. Many lives could be saved through wide-scale deployment of such systems.

* Universal Service Directive 2002/22/EC.



LIFE IN THE URBAN ENVIRONMENT

Once upon a time, our forward-thinking predecessors saw the city of the year 2000 as a place where streets would be quiet, safe places and where vast and efficient public transport systems would be a delight to use. Some west European cities have at least partly achieved this, but regrettably, many of our cities are still marred by traffic, noise and pollution. The number of cars per person is a key factor in all cities. At present there is a huge imbalance between the use of public transport (only 20 %) and private cars (80 %), with urban transport accounting for 40 % of carbon dioxide emission from road vehicles. While the situation is much worse in some parts of the world, for example in the Far East where pollution from millions of motorcycles leads to serious illnesses among local populations, in Europe, the encouragement of citizens to use public transport has the aim of reducing both pollution levels and congestion. These environmental gains can be better achieved through more efficient operational practices.

What and where?

Knowing the status and location of their fleets, public transport operators can offer valuable in-vehicle services through ITS, including real-time delay and arrival information, information on connecting services and on nearby facilities and points of interest, and efficient means of electronic ticketing and payment. Pedestrians can also be aided through the provision of visual displays and hand-held location and guidance systems.

Globally, the objectives of ITS within the urban context are:

- improving public transport information, i.e. routes, schedules, prices, etc.;
- allowing pre-planning of urban journeys, including parking;
- promoting other means of transport, for example providing cycle-path information;
- allowing journey modification while in progress, through information panels or via GSM;
- payment for services via smart card or GSM.

More specifically with respect to road applications, the objectives are:

- panels informing travellers about available 'park and ride' sites;
- traffic management, modifying signalling to improve traffic flow, giving public transport and emergency vehicles priority, modifying the direction of one-way streets during peak periods;
- travel-time information on highway roadsides;
- guidance systems allowing route modification during rush hours;
- parking and shuttle buses for tourists;
- location and identification of stolen vehicles using transmitting beacons or smart badges;
- limiting access to urban centres through badges or tolls.

Further information

For information about **ITS** and **ongoing ITS projects** in Europe, see the Energy and Transport DG's webpage at:

<http://europa.eu.int/comm/transport/themes/network/english/its/html/index.html>

For information about **GALILEO**, the European satellite navigation system, see:

http://europa.eu.int/comm/dgs/energy_transport/galileo/

TENs

The trans-European network for transport (TEN-T) is one of the trans-European networks (TENs) aimed at improving freedom of movement within the single market for goods, persons and services, linking the various regional and national networks through modern and efficient infrastructure.

http://europa.eu.int/comm/ten/index_en.html

FP6

The EU's sixth framework programme for research and technological development (FP6), launched in November 2002 with a budget of EUR 17.5 billion, provides funding for industrial research under a number of 'thematic priorities'. Set to run until 2006, its primary aim is to support the creation of a single European research area.

<http://www.cordis.lu/fp6/>

Marco Polo

The Community's Marco Polo programme intends to help the transport and logistics industry to achieve sustained modal shifts of road freight to short sea shipping, rail and inland waterway.

http://europa.eu.int/comm/transport/marcopol/index_en.htm

This brochure outlines the potential for using Intelligent transport systems in delivering the high-quality transport service foreseen in the European Commission's White Paper on European transport policy for 2010.



Publications Office

Publications.eu.int

ISBN 92-894-4786-9



9 789289 447867 >