ITS Roadmap Outline
"Intelligent Transport Systems (ITS) for more efficient, safer and cleaner road transport"
- Version 12 October 2007 -

1. INTRODUCTION

1.1 Policy framework

Mobility is a prerequisite for the way Europeans live today. Transport of people and goods is vital to satisfy this need for mobility and underpins our lifestyle by facilitating social interaction and the reliable distribution of goods across the continent.

The economic importance of transport was highlighted in the Mid-term review of the European Commission's 2001 White Paper on Transport Policy:

> "Effective transportation systems are essential to Europe's prosperity, having significant impacts on economic growth, social development and the environment. The transport industry accounts for about 7% of European GDP and for around 5% of employment in the EU. It is an important industry in its own right and makes a major contribution to the functioning of the European economy as a whole. Mobility of goods and persons is an essential component of the competitiveness of European industry and services. Finally, mobility is also an essential citizen right."

The three major challenges in the provision of sustainable transport include

- reduction of **congestion** and optimum use of the existing **capacity**: official estimates presented at a recent European Conference of Ministers of Transport (ECMT) showed that "road congestion costs, including commuting and leisure traffic as well as business and freight traffic, amounts to an average 1 percent of GDP in the European Union, with Britain and France at 1.5 percent."
- increase traffic **safety**: there were still 41100 fatalities on the EU roads in 2005, more than 4000 above the intermediate target derived from the target set by the White Paper (50% reduction in fatalities in 2010 compared to 2001)
- address the negative **impact on the environment** while **increasing energy efficiency and reducing the dependency on fossil fuels:** despite increasingly strict emission standards for road vehicles, air quality in cities does not yet meet the limit values set by European regulation. Road transport has significant impacts on climate change, with about 12% of the overall EU emissions of carbon dioxide (CO2) coming from the fuel consumed by passenger cars. Improvements in vehicle fuel efficiency have been neutralised by increased traffic and car size. While the EU as a whole has reduced its emissions of greenhouse gases by just under 5% over the 1990-2004 period, the CO2 emissions from road transport have increased by 26%.

These challenges are even more pressing considering the annual growth rates of 2% for freight and 1.5% for passenger transport.

On the other hand, in the light of the EU industrial and information society policies, time is ripe to reap the industrial and economic benefits presented by the development and implementation of new systems and services which will help to solve these societal problems

and could be exported to other continents, contributing as such to European industry competitiveness.

A broad range of measures can be taken to tackle the above challenges. The 2006 review of the White Paper on Transport Policy "*Keep Europe Moving*" highlighted the contribution that **innovation** can make to meet these challenges, by making use of inter alia available and emerging information and communication technologies (ICT) applied to transport. These applications are commonly known as **Intelligent Transport Systems and Services (ITS).** Indeed, many people recognise the role ITS can play to deliver safe, efficient, sustainable and seamless transport of goods and people on the European road network and its interfaces with the other modes of traffic as well as to safeguard the competitiveness of European industry. Ten years ago, technology did not have the capacity to deliver up-to-the-minute advice based on up-to-the-minute data/information. Whilst the equipment or the skills to utilise the state of the art technologies are not yet widespread, this evolution will drive the services provided forward.

1.2 Technological framework

ITS approaches are being developed for the different transport modes and for interaction between them (including hubs), with the strong support of the EU[1] (see also annex II for a more detailed description). However, in road transport the take-off has been slow in spite of the rapid development and introduction of ITS applications, supported by inter alia the Commission's research and development Framework Programmes, eSafety, CARS21 and EuroRegional TEN programmes and by the intelligent car initiative. In many of these applications satellite navigation already is a key component or has the potential to be one, and the Galileo programme provides the opportunity to integrate up-to-date technologies into these systems.

In addition it should be recalled that the ITS industry has strategic importance in its own right. Car and truck manufacturers, transport operators and logistics providers all derive a competitive advantage from integrating state of the art technologies into their products and services. European systems and component suppliers play a leading role worldwide. Hence the present initiative will also take a role as a "lead market" initiative as those undertaken in other areas of industrial policy. In particular, ITS will contribute to launching a whole series of new services for better informed citizens on environment and mobility: "information society" services.

The introduction of ITS is moving forward in different ways, as a function of the requirements of the various transport modes and of the degree of organisation of the sector.

However the pace of deployment in road transport is rather slow. Some examples:

● it has taken more than 20 years for RDS-TMC (Radio Data System – Traffic Message Channel) to come to fruition, mainly in navigation systems

[1] In air transport SESAR will be the framework for the development and implementation of a new generation of air traffic management. Inland waterways are introducing River Information Services to manage waterway utilisation and the transport of freight. The railway network is gradually introducing the European Rail Traffic Management System and Telematics applications for freight with technical specifications for interoperability. Shipping has already introduced SafeSeaNet and Vessel Traffic Monitoring and Information Systems and is progressing towards an Automatic Identification System and Long-Range Identification and Tracking.

● the overall penetration of ESC (Electronic Stability Control) in European cars was only 16% in 2006 although the safety benefits of ESC have been clearly demonstrated in several studies
● it has taken 10 years for the Electronic Toll Collection industry to reach agreement on a European standard for Dedicated Short Range Communications
● although in a number of locations in some Member States traffic is monitored at an appropriate level, still in a majority of Member States the traffic monitoring equipment on the trans-European road network doesn't guarantee reliable and fast traffic information service at an adequate level.

1.3 The way forward

The Commission services acknowledge the need to rely on the dynamics of the different industries, on the momentum of the markets and on a better co-ordination between all actors involved. Yet the **EU needs to play an active role in supporting and, where appropriate, in providing a lead towards the introduction of ITS** for a number of reasons:

- European policies need a strong ITS component to face the challenges of today in terms of infrastructure capacity, transport safety/security and environmental considerations;
- ITS is a powerful tool to offer citizens advanced services which make their mobility safer, more efficient and more comfortable. For businesses ITS offers more secure, efficient and environmentally friendly transport solutions;
- transport modes need to work together much more closely in order to enable seamless connections and to make it possible to use the most suitable carrier for various parts of a journey; ITS is the instrument that provides the platform for such a "co-modal" approach;
- the complexity of the industries, the large number of parties involved and the need to ensure synchronisation geographically as well as between the various partners, require overall organisation that can not be provided without public efforts at European level;
- the uncertainties stemming from long lead times and the time required to develop critical mass result in slow take-up and high initial costs, which could be alleviated by developing a consensus around a roadmap for deployment based on policy priorities and political considerations, common components and a clear timeline.

This initiative will focus on ITS in road transport and its links with other transport modes for both goods and people to complement the comprehensive approaches already pursued in other modes of transport, and will endeavour to:

- Put in place a **consistent and comprehensive policy framework** (organisational, regulatory, funding, standardisation) to encourage an innovative and effective approach addressing the above challenges;
- Provide a robust framework for **co-operation with the main stakeholders** (Member States, industry, user organisations) with a view to organising large-scale deployment of ITS in Europe;
- Create real **ownership** of different ITS applications, and
- State the **business case** for ITS provided by the above framework and vision, facilitating the creation of a uniform marketplace: highlighting how ITS technologies

and applications can contribute to reaching the three high level objectives and what actions are needed to make progress.

This initiative will benefit from a series of other ongoing initiatives such as the 2007Action Plan on Freight transport Logistics, the 2008 Action Plan for the Urban Transport, Galileo deployment, the Internalisation of external costs[2] proposal of 2008, the i2010 initiative on Intelligent Cars, eSafety, the 7th Framework Programme for Research and Technological Development, European Technology Platforms (e.g. ERTRAC, the European Road Transport Research Advisory Council) and their strategic research agendas, CARS 21 agenda, the integrated approach to reduce CO2 emissions from road transport, etc. and its outcome will serve as the basis for the **major initiative on ITS for 2008** already announced in the revision of the White Paper on European Transport Policy.

The public authorities at all levels (European, national, local) have the overall responsibility for the provision of transport and should therefore have a key role developing a cohesive deployment strategy for ITS.

It is essential to recognise however that others involved in the successful implementation and operation of these applications and services are fully engaged in this process. This includes infrastructure operators, industry (manufacturers of both vehicles and components; ITS products and communications), value added service providers (VASPs), digital mapmakers, enforcement agencies and infrastructure users.

2. APPROACH

The main elements in the provision of transport are the vehicle, the infrastructure and the human elements and freight. For each of these elements, ITS tools are available which can contribute to the objectives of realisation of additional capacity or reducing congestion ("*Efficient*"), improved safety ("*Safe*") and in light of the concerns on global warming and air pollution, minimising the adverse impact of mobility on the environment ("*Clean*").

The analysis in the annex to this paper develops in detail how the different ITS applications can contribute to achieve these objectives.

This paper will propose:

- How to select **priorities** to be pursued, as a function of the contribution that can be expected from the various ITS applications to policy objectives, in relation to their degree of maturity, or need for synchronised and coordinated implementation and synergies that exist between different applications and their components;
- How work could be **organised** with the Member States and the different stakeholder communities in order to review and update these priorities and to obtain input into the roadmap for deployment as well as commitment to pursue this roadmap; and

[2] An external cost, also known as an externality, arises when the social or economic activities of one group of persons have an impact on another group and when that impact is not fully accounted, or compensated for, by the first group. There are several ways of taking account of the cost to the environment and health, i.e. for 'internalising' external costs. One possibility would be via eco-taxes. Another solution would be to encourage or subsidise cleaner technologies thus avoiding socio-environmental costs.

- What **instruments** are available to the EU to support development and deployment efforts (legislation, standardisation, funding) and in which cases these instruments should be put to use.

3. PRIORITIES FOR DEPLOYMENT

It is proposed that the EU put as a priority on the deployment of a limited number of **core ITS components and applications** meeting the following criteria:

- to contribute clearly to one or more of the above high-level objectives
- to be mature or close to reaching maturity
- to present a clear benefit to the society and citizen
- capability to be rolled out in a consistent manner across Europe
- preferably to offer synergies with other applications.

This does not mean that these applications will as a rule be completely harmonised, but they will need to be devised to **ensure a minimum level of performance and functionality and to be interoperable**. In most cases this does not imply either that Member States or operators will as a rule be obliged to implement these applications (although there may be some situations where that is necessary for safety or interoperability reasons), nor does it prevent Member States or operators to put in place additional applications. But it does mean that **there will be a shared baseline that provides the platform for the rapid development of the ITS market as a whole**. Applications could also benefit from **an open in-vehicle telematics platform**, which would enable the emergence of a whole series of other applications and services.

This list should be maintained and updated periodically to reflect progress in deployment, development of new applications and new priorities. In the mean time all actors should continue investigating other promising ITS applications such as co-operative systems based on vehicle to vehicle communications and vehicle to infrastructure communications etc. which are still in the development phase.

Possible core ITS applications which meet the above requirements are:

- seamless real-time travel and traffic information including multi-modal journey planning and information system (contributing clearly to the three high level objectives)
- freight information systems combining operators' freight-flow & public authorities traffic flow requirements contributing to the optimum use of road capacity and the reduction of negative impact on the environment
- eCall leading to a reduction in fatalities
- Electronic Toll Collection as a key instrument for internalisation of external costs

● traffic demand management leading to cleaner road transport and less congestion
and
● the integration of several core applications on an open in-vehicle telematics platform.

User awareness and acceptance will play an important role in the successful deployment of these priority applications.

This list should be enhanced with a limited number of other core applications identified by the stakeholders themselves (see chapter 4). The matrix at the end of annex I can offer a useful tool for the selection of these core applications.

4. INSTRUMENTS

The Commission has earmarked over 2 billion € in **financial support** for the development and deployment of ITS technologies across different transport modes over the 2007-2013 period through its research and trans-European network programmes. In addition much of the infrastructure being built in Europe benefits from financial support under the EU's structural funds. This spending will increasingly need to be focused on the policy priorities that stem from the current initiative. This financial support might be made conditional on observing basic requirements such as the application of standards and specific data exchange protocols. Other EU financing mechanisms are the 7th Framework Programme for Research and Technological Development as well as the Competitiveness and Innovation Programme (CIP)

Many of the ITS technologies would benefit from **standardisation** ensuring that they comply with essential requirements relating to performance, that they are interoperable and that they quickly attain critical mass to ensure cost-effective production and deployment. The continuous updating of a European ITS framework architecture needs particular attention. Under mandates from the Commission, the European Standardisation Bodies will play a major role in conducting the standardisation process in an objective and transparent manner, taking into account the regulations and harmonization of standards at a global level.

A number of aspects of ITS deployment may need to be addressed through **legislation**. This would relate to the definition of essential requirements for performance and interoperability, and to the synchronisation of deployment across different Member States and between the different parties. Consideration could also be given to a requirement to assess the contribution ITS could make when planning major new infrastructure works. Last but not least to take a pro-active analysis for assessing the potential role/contribution of ITS when planning new policy initiatives/legislation (e.g. social legislation/tachograph, monitoring dangerous goods or live animals, road charging/tolling, protecting vulnerable road users, rules for distribution of freight, transport security, etc.). The Commission would also need to ensure that concerns that could stand in the way of rapid ITS development are properly addressed. These issues include liability for their production and use, provision of and access to traffic-related data, protection of personal data and privacy, and availability as well as health aspects of radio-spectrum. Consideration could also be given to the quality of the data, possibly through a certification scheme.

Other support measures to be considered are incentives launched by the Member States, public-private partnerships and soft approaches such as creation of frameworks/fora (e.g. eSafety forum) or user awareness.

5. WORKING METHODS

It is of paramount importance to devise a robust mechanism that will make it possible for the Commission, Member States, and the various stakeholder **communities to work together** on a continuous basis, in order to make sure that the development and deployment of ITS technologies reflects input by all interested parties and benefits from their commitment to implement. These stakeholders include inter alia public administrations/policy makers, vehicle manufacturers and equipment suppliers, road and terminal operators, road users, communications services providers, insurers etc.

The existing eSafety Forum is one of existing mechanisms that could be used, which brings together many of the actors concerned and which touches on many of the technologies that are relevant for ITS deployment. It would also be important to include the European Technology Platform for the road transport research ERTRAC (European Road Transport Research Advisory Council) and the European Intermodal Research Advisory Council EIRAC. Working relations with the Conference of European Directors of Roads CEDR and with ERTICO are also necessary. Co-ordination with national research activities should also be covered.

In a first stage senior representatives from the different stakeholders will be approached as individual experts and their feedback on the present outline road map will be sought (October-January 2007). Based on this feedback a first document would then be produced by February/March 2008. In parallel a wider consultation should take place via workshops and via the existing frameworks (e.g. European Technology Platforms, eSafety forum) and at the same time an impact assessment should be launched. During this process a framework should also be established which will enable to measure progress. The final roadmap should be ready by June 2008 and the related Commission Communication is planned for July 2008.

The final road map should contain, for each core application:

- the contribution to high-level objectives and deployment priorities (cf. chapters 2 § 3)
- the barriers to be removed
- description of the expected impact
- the actions to be undertaken
- the support tools needed
- the responsible actors
- the milestones to be achieved and the related timetable.

The action plan needs to integrate the co-modality perspective and address the **policy and business cases** for the deployment of various ITS technologies, ensuring that priority setting reflects the added value of these technologies for public authorities, for users and for other parties, as well as their cost.

Annex I: Analysis of the potential of ITS applications to contribute to safe, efficient and clean road transport

Efficient

Human element

A lot of energy and time is wasted because travellers are not adequately informed about transport options and traffic situation, leading sometimes to unnecessary congestion. More can be got out of the different transport modes and congestion can be reduced by helping the traveller to plan and execute his journey in a more efficient way (concept of a "connected traveller": continued movement through a network not hindered by the movement from one mode to another or from one part of a single mode network to the next.) The user's experience should be one of a seamless journey from beginning to end. This can be realised in a number of ways:
- by informing him of the different travel options (transport modes), needed time for the foreseen travel and tariffs
- by guiding him to his destination and keeping him informed in real time on possible deviations from the original schedule and on unexpected events
- in case of a car trip, by reserving and guiding him to a parking place at his destination.

These needs are particularly experienced by truck and other fleet drivers who have greater constraints (on time delivery, rest and driving time restrictions etc.)
Development of traveller information services can have economic benefits, if business models can be improved and public-private-partnership is enhanced (navigation is already a high-growth industry).
Convenient payment systems in public transport might contribute to modal shift.

ITS applications in this area include:

- *real-time and seamless (cross-border, pre-trip and on-trip) road traffic information and dynamic navigation (guidance for more conscious use of existing capacities (time and space*))
- *readily available (real-time) high-quality public transport information will support modal shift and free road capacity; integration of all forms of public transport to enhance customer usability*
- *Integrated multi- and intermodal journey planning will help to match travel demand with supply in a more balanced way (smart use of existing capacities) and better cope with growth; main support tool for seamless journeys; informed choice in terms of the time, mode and need for travel is crucial. Parking guidance and reservation systems*
- *freight management services to better inform the different actors in the transport chain (truck driver, fleet owner, freight forwarder etc.) on cargo location/transport situation and alternative transport modes and to reduce the paperwork (cfr. logistics action plan)*
- *Car sharing and car pooling schemes*
- *Electronic payment systems*

Vehicle (private, passenger, commercial)

A lot of primary accidents are caused by downstream traffic disturbances leading even to"secondary accidents" at the end of the congestion queue generated by the primary accident. The number of primary and secondary accidents could be considerably reduced by making the vehicle react more intelligently to these disturbances by warning the driver about the dangerous situation or even reacting automatically to avoid or reduce the impact of an impending collision.
Reducing headways between vehicles without jeopardising traffic safety has the potential to increase traffic capacity. Already today, truck drivers are reducing their headway without any tools to assist them in order to reduce fuel consumption and therefore leads to a negative impact on traffic safety, therefore a dedicated ITS tool would be very welcome and secure a practice that is already used**.**
Lane keeping systems could lead to a better distribution of truck axles on the road surface, reducing the wear and tear of the motorways and thus increasing time between successive surface maintenance interventions.

See the possible ITS tools under the "Safety" section.

Traffic levels could be reduced and congestion avoided by eliminating empty runs of trucks and/or by shifting goods transport from road to other transport modes or in time.

Possible ITS tools are fleet and freight management systems (including Telematics Applications for Freight, River Information Systems, SafeSeaNet), electronic databases matching demand and supply in freight transport, eFreight.

Infrastructure (strategic, urban, interface)

Well organised traffic management will result in Europe-wide efficiency within and across modes. From the knowledge of network performance, professional management of network operations can organise traffic movements to optimise the efficiency of the network using traffic simulation techniques linked with on-the-ground advice and control techniques. By deviating part of the traffic to parallel roads which are underused, potential congestion can be reduced, relocated or in some cases removed altogether resulting in greater network efficiencies.
Traffic management can also avoid traffic to become unstable and performing at less than capacity.
A basic requirement is for a real time understanding of how the network is performing. This entails appropriate traffic monitoring and incident detection systems to give instant pictures of network state and. near real-time traffic predictions coupled with weather forecasts. Individual Member State and city networks can no longer be considered in isolation – one network is connected with the next and needs to be coherent with it. Through the earlier research work in ITS and then through dedicated application of protocols a system of cross-border traffic control centre interconnections has been established but is far from complete. Also cross-border traffic management plans to cope with unforeseen incidents need further deployment.

The capacity of existing infrastructure can be optimised by fostering the linking of the different transport networks for the purpose of promoting intermodal mobility. All

modes working together providing the best from themselves and the best in combination (co-modality) will inevitably involve as a part of a journey the road mode to a greater or lesser extent.

The logistics chain can be made more efficient, more reliable and secure e.g. by a better integration of the different transport modes via the interconnection of the related information and management systems and by introducing more reliable methods to track and trace the cargo and by creating an "internet for cargo".

ITS tools available:
- Traffic monitoring, incident detection and verification
- Data and information exchange and sharing
- Traffic management, also cross-border, based on variable message signs, ramp metering etc.
- Urban traffic control systems
- Radio Frequency Identification (RFID) for identifying, tracking and tracing of cargo
- Positioning systems (GALILEO)
- Priority systems for public transport

Congestion can also be reduced by actively managing traffic demand e.g. by making drivers pay for road use or by limiting access to certain zones.

ITS tools: road pricing, congestion pricing, access management systems.

Increased capacity can also be obtained by reducing waiting times at toll stations or by introducing open toll systems.

ITS tool: interoperable electronic toll collection systems.

Safe

Safety has been a priority objective for a number of years. As part of the Road Safety Action Plan, a target was set to reduce the number of fatalities on our roads by fifty percent. The announcement was accompanied by concerted action on part of a range of stake-holders. These included public authorities responsible for provision and maintenance of infrastructure, vehicle manufacturers and individual drivers and users of transport. The initiative has had significant impact and has enjoyed sponsorship at political, business and individual levels. As part of these actions, contribution of responsible deployment of ITS has been recognised.

Human element:

In more than 90% of road accidents human error is an important element or is even the only cause. Most common are speeding, alcohol or drug consumption, tiredness, unsafe headways, red light running and overtaking manoeuvres. On top of this the consequences of accidents are aggravated by the fact that many drivers are not wearing seat belts.

Accurate, reliable and timely information on queues and other dangerous situations (safety related traffic messages and alerts on incidents, accidents, weather conditions) made available by authorities, commercial actors or other drivers will allow drivers to

avoid risky manoeuvres. Accidents can also be reduced by better informing the road user about the existing speed limits and warning him/her when these are exceeded.
Navigation and route guidance at complex intersections and in unfamiliar places will reduce driver stress and contribute to safer driving. Better information of truck drivers of existing constraints will also lead to less collision accidents with infrastructure (bridges, narrow streets etc.).
Information to the driver should always be given in a safe way, avoiding any information overload or misuse of information systems. In that respect a safe human machine interaction is of major importance. In that respect a new European Statement of Principles[3] has been issued in December 2006.
Equally important is the role that awareness and training can play towards provision of safe transport. More effective methods of training are needed especially to drive the new generations of cars equipped with several new sophisticated electronic devices.
It is also important that road users are respecting the existing regulations on speed and alcohol limits as well as seat belt wearing.
A shift to public transport, being the safest mode, has a major safety impact.

Possible ITS tools:

- *reliable information provision on static speed limits on the whole road network*
- *real time traffic information*
- *truck specific route navigation*
- *alcolocks*
- *interactive driving simulators*

Vehicle (distinguish between commercial and private):

Much effort has been spent on vehicle passive safety in the past decennia with great success. Even more significant safety gains can be expected in the future through active and preventive safety devices, making vehicles more intelligent. These devices will enable to achieve greater stability, by automatically warning the driver of dangerous manoeuvres, by avoiding collisions or by mitigating their consequences. In the case of accidents the vehicle can even transmit a distress signal to the nearest emergency rescue centre.
Active safety devices in vehicles should take full account of pedestrians and cyclists.

ITS tools:

Electronic Stability Control (ESC), collision avoidance and mitigation systems, emergency braking systems, intelligent cruise control, lane departure warning and lane keeping systems, eCall, safe speed, including speed alert

Infrastructure (strategic, urban, interface):

Accidents can be avoided by
- faster detection of abnormal and dangerous traffic and meteorological situations
- informing the road user as quickly as possible about these dangerous situations and the response required

[3] Commission recommendation of 22 December 2006 on safe and efficient in-vehicle information and communication systems: update of the European Statement of Principles on human machine interface (2007/78/EC, OJ L32, 06.02.2007, p. 200)

- taking the necessary measures to reduce the negative effects of incidents on the upcoming traffic (deviations, speed reduction etc.)
- enforcing the existing speed limits.

Emergency management should be optimised and special care should be given to dangerous goods transport.

Possible ITS tools:

- Incident detection and verification systems

- Traffic management systems which keep traffic in a stable situation (ramp metering, variable speed limits etc.) or warn traffic upstream of accidents/meteorological conditions or reroute traffic (variable message signs)

- Intelligent speed management systems

- Vehicle to infrastructure communication

- Enforcement systems (speeding)

- Dangerous goods tracking and tracing throughout all the modes by ensuring the interconnection with the ports and intermodal centres

- Emergency management systems: specific priorities can be given to advance certain vehicles through the network. The priorities can be implemented on a regular basis or as a Disaster Response measure. Public Safety Answering Points need to be adapted to be able to respond to eCalls.

Clean

- Although ITS applications are often not specifically geared towards environmental objectives there are many possibilities where ITS can contribute to a cleaner transport with less environmental impact and a more efficient use of energy. Some applications are already mature enough for a wider deployment. For others there is scope for future developments to use ITS to achieve environmental goals.

<u>*Human element:*</u>

A traveller could be better assisted before starting a journey so that he/she can make a better informed choice on the optimum mode, route and time of travel, all having a different impact on the environment. Especially environmentally-friendly options (i.e. public transport, non-motorised modes) could be highlighted as well as to reduce traffic in periods with high pollution levels.

Awareness raising and information are necessary to support changes in travel and driving behaviour, leading to reduced fuel consumption and emissions.

ITS tools

- Journey planners - On-trip route guidance from navigation systems and parking guidance systems - Eco-driving can be assisted by ITS tools (see next section)

- Pay as you drive insurance

Vehicle

On the vehicle side supportive tools for a more environmentally friendly use need to be more widely deployed to make a higher impact. Fuel consumption and/or emissions could be monitored and feedback given to optimise driving style and vehicle behaviour. This is especially useful for commercial vehicles (trucks, buses) and fleets with a high amount of kilometres driven.

Reducing headways between vehicles without jeopardising traffic safety has, apart from an efficiency effect, also the potential to save energy. This is already used by truck drivers without having the adequate tools to assist them and leads to a negative impact on safety.
Public transport operations – especially in areas and times of lower demand - can be made more efficient in the allocation of vehicles (with an environmental impact)

ITS tools:

- *To support eco-driving*

- *Tyre pressure monitoring systems and gear shift indicators can help to reduce energy consumption. They are already part of the integrated approach put forward in the Community Strategy to reduce CO_2 emissions from passenger cars and light-commercial vehicles (Commission Communication COM(2007)19)*

- *Demand-responsive public transport systems supported by innovative IT planning and communication tools.*

Infrastructure & Management

An intelligent management of both travel demand and existing road traffic according to environmental objectives is needed.

Efficient and ubiquitous road infrastructure charging can help relieve congestion and contribute to diminish emissions per passenger or unit of goods transported.

Indeed congestion of road and parking spaces harms the economy by negatively impacting businesses and personal productivity of the enterprises and people living in congested areas.

Congestion raises the levels of emissions from road transport.

Fine tuned electronic fee collection (EFC) (road infrastructure charging) may compensate for the shortcomings of more traditional schemes like fuel taxation or vignettes.

Traditional means usually do not distinguish between congested and uncongested roads and times, hence offering road authorities no ability to design pricing signals that could be used to control congestion. EFC can send properly designed pricing signals telling the motorists that it is more costly to drive in congested areas or at congested times.

EFC will enable jurisdictions at various levels (European, national, regional or local) to engage in large areas transportation and parking demand management specifically via market pricing mechanisms.

Road pricing, when implemented as part of a wider package of demand management, information provision and public transport improvement, can reduce journey times and improve journey time reliability.

Innovative use of ITS systems especially in urban areas will enable a wider range of objectives to be addressed including reduced emissions, better air quality etc., e.g. specific algorithms in urban traffic control systems to come into play when poor air quality is detected.

ITS support tools:

- Travel demand and mobility management can reduce road traffic levels or channel it to routes and areas that are less sensitive. This includes:

- *Journey planning (supporting modal shift)*
- *Road charging (with environmental criteria)*
- *Environmental zone access control (in urban areas with high air pollution)*
- *Public transport priority schemes (in urban areas)*

- If traffic is already on the road its environmental impact can be reduced by

- *Network monitoring (with regard to air quality and emissions)*
- *Speed management*
- *Traffic & access control (with priority for clean vehicles)*
- *Traffic information and route guidance*

- Because of its greater environmental risk specific emphasis should be placed on hazardous goods transport (tracking and tracing systems)

- Systems for proper enforcement of speed and access control measures

The attached table on the next page presents a first assessment by the European Commission services of the potential contribution of the main Intelligent Transport Systems and Services to the EU policy objectives.

EU Policy Objectives →	Transport Efficiency							Safety and Security				Environment and Climate Change		Economy				Accessibility	Internalisation of External Costs
Sub-Objectives → / ITS Applications ↓	Congestion Reduction	Inter-urban corridors	Urban mobility	Sensitive areas	Freight transport (incl. cross-border formalities)	Collective transport	Intermodality	Road safety	Hazardous goods	Freight transport security	Public transport security	Environmental impact	Energy efficiency	Internal Market	Peripheral states	Auto industry	Telecoms & ITS industry		
Network operations																			
Cross-border traffic control centre inter-connections	●●●	●●●	●	●●●	●●	●	●	●	●●	●	●	●		●●	●		●		
Near-term traffic predictions and weather forecasts	●●●	●●●	●●●	●●●	●●	●	●	●●●	●			●●		●	●			●●	
Wide area seamless traffic management (incl. cross-border)	●●●	●●●	●●	●●●	●●	●●	●	●	●●			●●	●●	●	●●		●		
Event and emergency planning and incident response	●●●	●●●	●●●	●●●	●●●	●●		●●●	●●●	●●●	●●●	●●●	●	●	●			●●	
Fast alert system (black spots)	●●●	●●●	●●	●●●	●●●	●●●	●	●●●	●●●	●	●	●●●		●	●			●	
Real-time traffic & event databases	●●●	●●●	●●●	●●●	●●●	●●●	●●		●●	●	●	●●	●	●●				●●	
Travel demand management	●●●	●●●	●●●	●●●	●	●●	●●●					●●●	●●	●●	●		●	●●	
Network performance measures & data archive	●●●	●●●	●●●	●	●●●	●●●	●●●					●●●	●	●●	●●		●		
~~Public transport priority (on-~~ *intersections)*	●●	●	●●●	●●		●●●	●●	●			●	●●	●●				●	●●	
Traffic & Travel Information																			
(Dynamic) Navigation & digital maps	●●●	●●●	●●●	●●●	●●●	●●	●●	●	●●●	●●		●●	●●	●●	●●●	●●●	●●●	●●●	
Real-time road traffic information (pre-trip / on-trip)	●●●	●●●	●●	●●	●●●	●	●	●	●	●●		●	●●	●	●		●●	●	
Parking information	●●	●	●●●		●●							●	●			●			
Real-time public transport information (pre-trip, on-trip)	●●	●●●	●●●	●●●		●●●	●●	●			●	●●	●					●●●	
Multi-modal journey planning	●●●	●●●	●●●	●●	●	●●●	●●●	●				●●	●		●			●●●	
Electronic Payment																			
Electronic Fee Collection																			
‣ Electronic toll payment	●	●●●		●	●●	●						●	●	●			●		
‣ Lorry tolling & charging	●●●	●●●		●●●	●●●		●		●	●		●●●	●●	●●					●●●
‣ Congestion charging	●●●		●●	●●	●●	●●●	●●●	●				●●●	●●●					●●●	●●●
‣ Value pricing (for priority)	●●●	●	●			●	●					●	●						●●
Public transport payment and ticketing			●●●			●●●	●●●					●					●●		
Parking ~~payment~~ *Management*	●●	●	●●●	●●			●●	●●				●●	●●			●●	●●	●	●●
Public transport operations																			
Vehicle location, timetables and reliability	●●		●●●			●●●	●●●				●●●		●				●	●	
Demand responsive public transport			●			●●●	●●	●				●	●●		●●		●	●●●	
eCommerce B2B / B2C																			
Mobile communication & location-based added-value services		●●	●●	●	●●●	●	●			●	●	●	●	●		●●●	●●●	●●	
Commercial vehicle operations (freight)																			
Intelligent logistics , timetables and reliability	●●	●●	●●●		●●●	●●●	●●●		●●●	●●●	●●	●	●●	●●●	●●●		●		
Electronic manifest & customs clearance							●●●			●				●●●	●●				
Lorry routes & truck navigation	●●	●●●	●	●●●	●●●		●●●	●	●●●	●●		●●●	●●	●●	●				
Truck stop, loading bay & truck parking real-time information	●●●		●	●●●	●●●		●●●		●●●	●		●●●	●●●	●●					
Sensitive goods cargo tracking and management		●●●		●●●	●●●		●	●	●●●	●●●		●●●		●	●				
Hazardous materials security and incident response		●●●		●●	●●●			●●●	●●●	●●●		●●●							
On-board safety and security monitoring					●●●					●●●									
Advanced Safety Systems																			
Emergency call systems	●							●●●	●●●		●●●					●●●	●●●	●●●	
In-vehicle HMI *(impact on driver)*	●							●●●								●●●		●●●	
Speed warning	●	●	●●●	●●				●●●					●			●●●		●●●	
Longitudinal collision avoidance								●●●								●●●			
Lateral collision avoidance								●●●								●●●			
Vision enhancement								●●●								●●●		●●●	
Pre-crash restraint systems								●●●								●●●			
Co-operative vehicle-to–vehicle (v2v) systems	●●●	●●●			●●●			●●●								●●●	●●●		
Co-operative vehicle-to–infrastructure (v2i) systems	●●●	●●●			●●	●●●		●●●								●●●	●●●		
Crash avoidance at intersections	●●●							●●●								●●●	●●●	●●●	
Electronic Stability Control	●							●●●					●			●●			
Lane keeping/warning systems	●	●						●●								●●	●		
Tyre pressure monitoring	●							●●				●●	●●			●●	●		
Emergency management																			
Emergency notification and personal security	●	●	●		●●●	●●		●	●●	●●●	●●●								
Emergency services vehicle management	●	●●	●	●		●		●●●										●	
Disaster response and evacuation		●●	●●															●	
Enforcement systems																			
Emissions testing & control		●●	●●	●●	●							●●●	●●●	●●				●●●	
Speed enforcement	●●	●●	●●	●	●●	●		●●●				●●	●●					●●	
Non-payment of fees and charges			●●●											●●			●		
Unlicensed vehicles / drivers					●			●●●						●●					
Over-loading enforcement					●●			●	●			●●		●●					
Drivers' hours enforcement					●●●			●●●						●●					
Road worthiness enforcement	●							●●				●●	●●			●●			

Legend: ● slight impact ●● considerable impact ●●● very important impact

Annex II: Community initiatives and programmes related to Intelligent Transport Systems in all transport modes

1. GALILEO

GALILEO is Europe's initiative for a state-of-the-art global navigation satellite system, providing a highly accurate, guaranteed global positioning service under civilian control. While providing autonomous navigation and positioning services, GALILEO will at the same time be interoperable with GPS and GLONASS, the two other global satellite navigation systems. A user will be able to take a position with the same receiver from any of the satellites in any combination. By offering dual frequencies as standard, however, GALILEO will deliver real-time positioning accuracy down to the metre range, which is unprecedented for a publicly available system. It will guarantee availability of the service under all but the most extreme circumstances and will inform users within seconds of a failure of any satellite. This will make it suitable for applications where safety is crucial, such as running trains, guiding cars and landing aircraft. The combined use of GALILEO and other GNSS systems will offer much improved performances for all kinds of user communities all over the world.

The fully deployed GALILEO system will consist of 30 satellites and the associated ground infrastructure.

More information on the website:
http://ec.europa.eu/dgs/energy_transport/galileo/index_en.htm

2. SESAR

The SESAR project is the European air traffic control infrastructure modernisation programme. SESAR aims at developing the new generation air traffic management system capable of ensuring the safety and fluidity of air transport worldwide over the next 30 years.
Website: http://ec.europa.eu/transport/air_portal/sesame/index_en.htm

3. European rail traffic management system (ERTMS)

ERTMS aims to remedy the lack of unification in the area of railway signalling and speed control – a major obstacle to the development of international rail traffic. Standardising the multiple signalling systems in use will bring increased competitiveness, better inter-working of freight and passenger rail services, stimulate the European rail equipment market, reduce costs and improve the overall quality of rail transport.
Website: http://ec.europa.eu/transport/rail/interoperability/index_en.htm

4. River Information System Services (RIS)

River information services means harmonised information services to support traffic and transport management in inland navigation, including, wherever technically feasible interfaces to other transport modes. RIS aim at contributing to a safe and efficient transport process and at utilising the inland waterways to their fullest extent.
Website: http://ec.europa.eu/transport/iw/index_en.htm

5. SafeSeaNet

The SafeSeaNet system has been developed for supporting the requirements of the Directive 2002/59/EC of the European Parliament and of the Council of 27 June 2002 establishing a Community vessel traffic monitoring and information system. The system is accessible to the National administration of the Member States of the European Union and of the European Free Trade Association States.
Website: http://www.emsa.europa.eu/end806.html

6. Intelligent Car Initiative

The intelligent car initiative will accelerate the deployment of intelligent vehicle systems on European and international markets, using a mix of policy, research and communications instruments to:

- ensure interoperability across different EU countries and harmonise technical solutions through a comprehensive European approach;
- support ICT-based research and development in the area of transport (6tha and 7th Research and Development Framework Programmes) and facilitate the take-up and use of research results;
- raise awareness among consumers and decision-makers of the potential benefits of ICT-based solutions.

Website: http://ec.europa.eu/information_society/activities/intelligentcar/index_en.htm

7. Euro-regional projects (TEMPO programme)

Due to the numerous European actors involved in the traffic management and information services, a European approach is absolutely necessary to offer the European citizen a set of consistent and seamless road network services. That is why the European Commission initiated the TEMPO programme (2001-2006), supported via the Trans-European Transport Network budget, with 7 Euro-Regional Projects (ERP). These projects were designed on a European traffic corridors basis, and are ITS deployment based.
A budget of 300 M€ is foreseen under the 2007-2013 TEN-T programme to support the further roll-out of ITS on the Trans-European Road Network.