SPEED MANAGEMENT:
MAIN CONCLUSIONS OF THE OECD-ECMT STUDY

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ABSTRACT

The speed at which vehicles travel is increasingly perceived as the origin of various health (notably road safety) problems, as well as environmental and social problems. At the same time, speed is very often presented in the industrialized countries as positive, essential to success in commerce and also to personal satisfaction, particularly for drivers.

In fact, the influence of speed appears in several domains: road safety, atmospheric pollution and traffic noise, non-renewable energy consumption, transportation system efficiency, and more generally economy. Speed may also have an influence on urbanism and urban sprawl.

A Working Group on Speed Management has been launched under the aegis of the Joint Transport Research Centre (JTRC). This Centre is a common centre of the ECMT (European Conference of Ministers of Transport) and the OECD (Organisation for Economic Co-operation and Development). The Working Group (which comprises representatives from 17 countries) began its work in April 2004 and the report has been published end of 2006 (English version) and February 2007 (French version).

The paper will summarise the main aspects of the report. It also shows how the new technologies - ITS (Intelligent Transportation Systems) - could open new avenues in this field, notably for improving road safety.

1. THE INTERNATIONAL CONTEXT

The Working Group on "Speed management" has been put in place by the JTRC (Joint Transport Research Centre), which is a common centre depending on OECD and ECMT. But what is it exactly?

From the official documents, "the Organisation for Economic Co-operation and Development is a unique forum where the governments of 30 market democracies work together to address the economic, social and governance challenges of globalisation as well as to exploit its opportunities.

The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and co-ordinate domestic and

international policies. It is a forum where peer pressure can act as a powerful incentive to improve policy and which produces internationally-agreed instruments, decisions and recommendations in areas where multilateral agreement is necessary for individual countries to make progress in a globalized economy".

Six "semi-autonomous" bodies are linked to OECD ; ECMT (European Conference of Ministers of Transport) is one of them.

The European Conference of Ministers of Transport (ECMT) is an intergovernmental organisation established by a Protocol signed in Brussels on 17 October 1953. It comprises the Ministers of Transport of 44 full Member countries, 7 Associate countries and 1 Observer country.

In Europe, the ECMT helps to create an integrated transport system that is economically efficient and meets environmental and safety standards. At their meeting in Dublin, Ireland, in May 2006, the Council of Ministers agreed on the creation of an International Transport Forum, which would include a much wider group of countries in its membership. The founding members of the Forum consist of the 51 ECMT Members and Associate Members. Other economies are also expected to participate in the future. The yearly Forum will provide Ministers of Transport with an opportunity to discuss topics of global, strategic importance, relating to all modes of transport, and will include the participation of leading non-government actors. The aim of the Forum is to bring high-profile, international attention to the essential role played by transport in the economy and society, while facilitating the integration of transport and logistics into key policy-making processes.

A few years ago, it has been decided, by the OECD council and by the CEMT Ministers, to reinforce the links between OECD and ECMT. This reinforced partnership is notably expressed by the creation of the JTRC, Joint Transport Research Center. "The Joint OECD-ECMT Transport Research Centre was established on 1st January 2004 following the OECD's Council Resolution and the ECMT Ministers Declaration. The Centre was formed by merging the OECD Road Transport and Intermodal Linkages Research Programme and the ECMT Economic Research activities. All OECD and ECMT countries are full members of the Transport Research Centre. The objective of the center is "to achieve international recognition as a centre of excellence, providing member countries with high quality, policy relevant research on transport and its contribution to society and sustainable economic growth across the world."

The JTRC launched several Working Groups, including one dealing with "speed management"; this group was chaired by one of the authors of the current paper.

2. INTRODUCTION: SPEED AND ITS EFFECTS

N.B.: the following text is closely inspired by the executive summary of the report.

Introduction to the report

Over the past decades, society and individuals have benefited greatly from rapidly improving road systems. During the same period, industry has manufactured and sold motor vehicles able to travel at increasingly high speeds. Higher speed vehicle transport has contributed to the economic development of OECD/ECMT countries, and has

contributed to improvements in the general quality of life. On the other hand, these higher vehicle speeds have had major adverse impacts, principally in terms of road accidents and consequent death, injury, and material damage, but also in environmental terms including noise and exhaust emissions and in terms of the liveability of residential and urban areas.

Recently, there has been increasing demand, particularly in urban areas, for strategies that reduce such adverse impacts. A growing portion of the population has sought to improve road safety, reduce adverse environmental impacts and improve the general quality of life. In urban areas in particular, residents are increasingly in favour of lowering vehicle speeds in order to protect the environment, provide a better level of amenity for the general resident population, better protect those living near roads, and in particular ensure the safety of pedestrians, bicyclists, children and people with reduced mobility.

Speed management policies which can deliver these outcomes have become a high priority in many countries.

The effects of speed

Speed has many positive impacts, the most obvious being that it allows a reduction in journey time and therefore enhances mobility. Advances over the past century in roads, motor vehicles and road transport have decreased travel times significantly – and have also contributed to the development of national economies, facilitated access to goods and services and facilities such as hospitals, entertainment and shopping centres, and in turn widened opportunities for housing, jobs, *etc.* These advances have clearly contributed to improvements in the general quality of life.

Speed also has some strong negative consequences (*e.g.* on road safety and the environment) and can contribute to significant adverse impacts on the liveability of residential and urban areas.

The problem of speed

Excessive and inappropriate speed is the number one road safety problem in many countries, often contributing to as much as one third of fatal accidents and an aggravating factor in all accidents.

Speeding - which encompasses excessive speed (*i.e.* driving above the speed limits) or inappropriate speed (driving too fast for the prevailing conditions, but within the limits) - is dangerous. Speeding is a contributing factor in around one third of fatal accidents, and actual speed is an aggravating factor in the severity of all accidents.

As the impact speed increases, the forces that vehicle occupants must absorb in a crash increase dramatically, in accordance with kinetic energy principles. Occupant protection systems are very effective at low and moderate speeds. However, they cannot adequately protect vehicle occupants from these kinetic forces at high impact speeds.
Vulnerable road users are particularly exposed to vehicle impacts -especially in urban areas- at speeds which are above the limits of human tolerance.

Excessive speed is a widespread social problem, which affects the entire road network (motorways, main highways, rural roads, urban roads) but is a much more significant problem on lower speed roadways. Typically, at any time, 50 % of drivers are above the

speed limits. Often, drivers exceed speed limits by less than 20 km/h, whereas a minority of drivers drive faster than 20 km/h above the limit. Speeding concerns all types of motor vehicles and all groups of road users. However, young drivers are the group the most involved in speeding behaviour.

The significant adverse road safety impacts of higher vehicle speeds have been confirmed by extensive research. Modelling of the impacts of changes in vehicle speeds has led to the following rule of thumb[1]:

- A 5 % increase in average speed leads to approximately a 10 % increase in all injury accidents and a 20 % increase in fatal accidents.

The same research indicates the positive impacts of reducing vehicle speeds:

- A 5 % decrease in average speed leads to approximately a 10 % decrease in injury accidents and a 20 % decrease in fatal accidents.

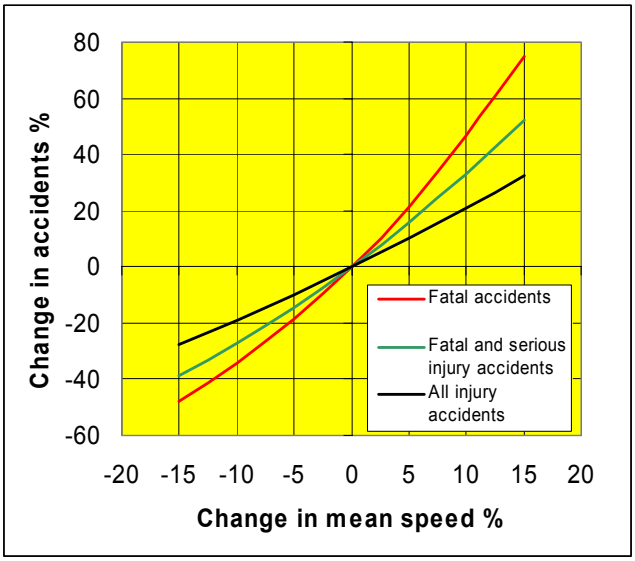

Figure1: the Power Model (Source: Nilsson)

Reducing speed by a few km/h can thus greatly reduce the risks of accidents as well as mitigating the consequences of an accident[2]. However, artificial speed limit reductions, to the point where drivers do not find the speed limits credible or reasonable, present their own highway safety problems. Merely reducing the speed limits can, in fact, increase accidents if it significantly increases the speed variablility between vehicles. The safest traffic flows on high speed roads are those where most drivers are traveling within a similar speed band because this reduced the number of overtaking maneuvers. Although the 85th percentile is (or was!) often cited as the most appropriate starting point for determining the speed limit, what is critical is that the speed limit reflects, without compromising safety, the prevailing speed of traffic. If lower speeds are desired, engineering countermeasures to slow speeds or extensive and consistent speed enforcement are necessary.

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1 These are approximate figures, easy to remember. Exact figures found by Nilsson are the following: a 10 % increase in mean speed leads to a 21 % increase in all injury accidents, a 33 % increase in fatal and severe injury accidents and a 46 % increase in fatal accidents. A 10 % decrease in mean speed, there are 19% less injury accidents, 27 % less fatal and severe accidents and 34% less fatal accidents.

2. As an example, in Melbourne (Australia), when the speed limit on the rural freeway network was increased from 100 to 110 km/h in 1987, the injury accidents increased by 24.6 %. When the speed limit changed back to 100 km/h in 1989, the injury accidents decreased by 19 %.

Recognising the broad concerns, the Secretary General of the United Nations, in his report[3] to the General Assembly on "Improving global road safety", has invited member States to "take action on inappropriate and excessive speed".

Higher vehicle speeds also contribute to increased greenhouse gas emissions, fuel consumption and noise and to adverse impacts on quality of life especially for people living in urban areas.

Speed has important impacts on the environment as it is strongly related to the emissions of greenhouse gases (mainly CO_2) and of local pollutants (CO, NOx, HC, particulates), as well as to increasing fuel consumption. Ozone -which comes from chemical reactions involving hydrocarbons, oxides of nitrogen, and sunlight- is also affected by speed. Speed also has a considerable impact on the exterior noise that a vehicle emits and therefore on overall levels of traffic noise, which are another major concern, particularly in urban areas and at night time.

Travel speed, actual and perceived, can affect -both positively and negatively- people's assessments of their level of amenity. Greater mobility, faster travel, and better access to facilities and services improve general assessments of the quality of life, while the significant adverse impacts such as on the environment detract from such quality of life. Some impacts such as injury or noise can be measured; others are more difficult to assess. Disruption to local communities, or fear of fast moving vehicles which may discourage individuals from walking or cycling, or restrict their ability to reach destinations easily are not readily quantifiable but can still have a considerable impact on the people concerned. In these cases, the social costs of speed are borne mainly by those outside moving vehicles.

Speed management is not incompatible with mobility and economic needs.

Mathematically, higher speed leads to reduced travel time. However, the effects of speed in reducing travel time are generally overestimated by road users and, at least in urban areas, the time savings are often small or negligible because of intersections and delays at traffic lights (in Toulouse, France, trials have shown that, on rather long journeys –about 20 km-, the increase of the travel time would be approximately 20 %, if the speed limit would be changed from 50 to 30 km/h –assuming the fact that this lower speed limit is well respected-). On high-speed, controlled access roads, this overestimation by road users is less significant. As well, reducing the average speed of the flow does not necessarily reduce the capacity of the road. For example, the maximum capacity of an urban motorway is obtained at a speed between 70 and 90 km/h (this fact is very often ignored and should be highlighted when necessary).

3. MAIN RECOMMENDATIONS

After the aforementioned statements, the report presents several recommendations. They are provided hereafter in bold, with commentaries and details.

[3]. United Nations General Assembly, Document A/60/121 dated 1 August 2005.

Development of a speed management package that achieves the right balance between the individual speed management measures.

The speed management package will need to consider the following elements: infrastructure improvement, speed limits, appropriate signing and marking, vehicle engineering, education, training and incentives, enforcement and driving assistance technologies. In addition, a key element of the success of speed management policy is the measurement of speed. All countries are encouraged to monitor speed on their road network regularly, as this is a major performance indicator with respect to both safety and environmental objectives. This holistic approach that includes coordination between engineering (roadway and vehicle), education and enforcement is most likely to succeed in reducing speeding-related fatalities and regular evaluation is a critical addition to ensuring success.

Education and information to the public and policy makers about the problem of speeding

This is a prerequisite for the successful implementation of speed management actions. The most successful education and information programmes encompass the logical basis of the speed limit system, and the reasons for speed management measures, highlighting the positive outcomes of these measures, as well as the environmental benefits (air pollution and noise) of moderated speeds. Educating policy makers about appropriate means to reduce speeds can be challenging. Speed limits set by politics rather than analysis, can be difficult to enforce, reduce credibility, and may cause more problems.

Education, training and information programmes are matters of concern to the entire population. However, different actions are required where children, teenagers, young drivers or drivers in general are concerned. Education and training of learner drivers needs to focus on the risks and other disadvantages of speeding so that these become an explicit issue in driver training. It is important that the driving instructors themselves are educated on the issue of speed and its effects.

Drivers who are already licensed form the largest group of interest, but they are also very difficult to reach. Countries generally rely on information campaigns, *e.g.* by billboards alongside the road or messages on television. Information campaigns are indispensable when used to support other measures but will have little effect if they are applied as a stand-alone measure. The production and dissemination of this information should be a continuous activity.

At the same time, advertisements for cars should not glamorize speed, as it is currently often the case. The depiction of speed in advertising of cars, motorcycles and even SUVs, both in print and television media, is widespread but should be actively discouraged. Progress could be made through voluntary agreements on new advertising standards. Governments need to encourage manufacturers to replace the emphasis on speed with positive messages about the benefits of vehicle features and technologies that can improve safety while reducing journey times and the stress of driving. Euro-NCAP crash test programmes offer an opportunity for governments to encourage manufacturers to offer safety-related speed management systems on new vehicles and to inform the public of their potential benefits.

Appropriate speeds for all types of roads in the network and review of existing speed limits.

Appropriate speed is a trade off between mobility, environmental and safety considerations that should reflect the human tolerance to impact speed. Appropriate speeds need to be determined for all types of roads in the network and existing speed limits reviewed to assess whether they reflect the appropriate speed in relation to accident risks based on road function, traffic composition, presence of vulnerable road users, and road design and roadside characteristics. Road function is, and should continue to be, an important decision factor in determining the speed limit, particularly where roadways are appropriately designed to match the desired function. Controlled access roadways where vulnerable road users are not present and interruptions to traffic flow are minimal can continue to operate at high speeds, whereas local roadways serving many kinds or road users need to have lower speed limits, along with design features that assist drivers in selecting the appropriately low speeds.

Speed limits are one way to achieve appropriate speeds. The speed limits chosen must be credible in the light of the road and road environment characteristics. Public authorities have the responsibility of ensuring this credibility and appropriate roadway design features add to this credibility There should be a clear differentiation between speed limits on motorways and other roads in order to maintain the attractiveness of the motorway which is the safest road category. A survey of 24 countries indicates that this is, indeed, the case, with an average speed limit on motorways of just over 115 km/h.

In urban areas, speed limits should not exceed 50 km/h[4] with 30 km/h zones promoted in areas where vulnerable road users (including children) are particularly at risk. Research shows that these lower limits, when accompanied by traffic calming measures, are very effective at reducing accidents and injuries, with reductions of up to two thirds having been demonstrated. The addition of appropriate traffic calming measures is critical in achieving the necessary speed reductions – posting lower speed limits without such measures rarely achieves the desired speeds. Furthermore, it is not excluded to set up some 70 km/h limitations, especially in transition zones between rural and urban areas.

Harmonised speed limits across regions (*e.g.* Europe, North America) can contribute to their improved credibility and promote an increasing level of acceptance among the general public.

In appropriate conditions, the application of variable speed limits may help to optimise both safety and public acceptance. Variable or dynamic speed limits may be triggered by time of day, weather conditions, traffic volumes or other criteria.

Drivers need to be informed at all times on what the speed limit is.

A traditional and cost-effective way is to use consistent roadside signing and road markings and much progress can still be made in their application. In some cases, regulatory speed limit signs are supplemented by lower advisory speed limit signs before curves, or other features that may require a driver to slow down.

4. In 1996, ECMT Ministers recommended considering a maximum speed limit of 50 km/h in urban areas, however this limit is still not implemented in some ECMT countries.

As well, there are emerging technology applications which could allow the speed limits to be confirmed in other ways. For example, variable signs can deliver messages suited to the current road conditions, and are therefore more credible than fixed signs. Use of speed feedback boards, that display the actual speed limit as well as a message to the drive on his/her actual speed are another use of technology that can be applied to provide reminders to drivers on appropriate speeds. This use should be done cautiously, in order to avoid to indirectly encourage to overpass the speed limit. Furthermore, the variable signs are much more expensive than the fixed ones, and the compatibility between fixed signs and variable signs is sometimes difficult to achieve. Road markings are a less expensive method, not only to display the speed limit, but to provide perceptual cues to drivers when lower speeds are desired.

Speed limits can also be displayed (or they will be displayed, as soon as the relevant databases will be available) on the dashboard, through a vehicle-infrastructure communication system (or with a GPS system + a speed limits database, both elements being in the vehicle).

Infrastructure improvements which aim to achieve self-explaining roads.

Each road should have a clear function: access, distribution or flow. For each of these functions, there is a corresponding appropriate speed, which should be suggested by the infrastructure design. This contributes to safe, "self explaining" roads, where drivers recognise the type of road and are guided to adapt their speed to the local conditions. “Self explaining” roads can be challenging to achieve, however, on roads with mixed functions.

Infrastructure improvements are often easier and cheaper to implement in built-up areas, where immediate safety benefits can be made. Research has proven that traffic calming measures such as speed humps and road narrowing are likely to be cost-effective in dwelling areas, near schools, at pedestrian crossings, *etc*.

On rural roads, infrastructure speed management measures are more difficult to implement because of the extent of the network and the costs involved. Improvements can be made by removing roadside obstacles to make the road safer and more forgiving. Appropriate clear zones can be achieved on long stretches of rural roads, but they are expensive, and other techniques that provide a safety margin for drivers can be applied as well. For example, less expensive, but also effective, is the use of edge line or center line rumble strips, to alert drivers when they are leaving their lane. While the ideal solution would be to separate traffic on rural roads (using median barriers for example), resource constraints prevent this being done widely; alternative solutions, such as the possible use of new technologies, should therefore be pursued as well.

When the infrastructure cannot be upgraded, at reasonable costs, to the standard required for the existing speed limit, the appropriate action is to lower the speed limit, keeping in mind that merely changing the signing is not likely to result in lower speeds. This is a situation where a holistic approach including engineering, education and enforcement must be applied.

Appropriate level of traditional police enforcement and automatic speed control.

Both traditional and automated speed control, including the use of mobile cameras - backed up by effective penalties- are needed to complement the other speed management measures in order to achieve their full effect.
Enforcement should encompass all road users (*e.g.*, motorcyclists and truck drivers), including foreign drivers. In the case of automatic enforcement, experience has shown that better results are obtained when the vehicle owner, who is easier to identify than the driver, can be legally responsible for the violation.

Section control (*i.e.* control of average speed on a section of road) has proven to be a cost-effective way to enforce speed limits, suggesting that further experience should be encouraged.

Tolerance levels for speed limit excess should be set at a minimum (*e.g.* 5 %), allowing for possible inaccuracies of the measurement device and speedometers. Setting higher tolerance levels above speed limits gives a misleading signal to the drivers and makes the speed limit system less credible. Also, insuring that the posted speed limit (and therefore the tolerance for speed limit excess) is appropriate for the roadway and traffic is important in the success of an automated enforcement system. Public trust can rapidly deteriorate if drivers perceive the automated system as a "speed trap".

Randomness of enforcement is a major determinant of driver's subjective assessment of risk of apprehension. Therefore, an "anywhere anytime" enforcement programme could be expected to have more wide ranging effects especially if linked to publicity.

Experience with automatic enforcement has shown that it is a cost effective approach which has a safety impact at a network level and not only at the location of the cameras[5]. However, a prerequisite to the successful large scale implementation of automatic speed cameras is provision of adequate information to the media, interest groups and the public, as well as ensuring that appropriate engineering solutions have been applied. Re-investment of the revenues from fines in highway safety measures (including speed camera operation) will reinforce that the purpose of automatic enforcement by speed cameras is to improve road safety. In a truly successful automatic speed enforcement program, the revenues would decrease over time as fewer and fewer drivers would be operating at an inappropriate speed.

Development of vehicle engineering.

Maximum speeds of passenger cars, light trucks, sport utility vehicles and motorcycles have increased greatly over the past 30 years. Almost all passenger cars sold in 2006 can go beyond 150 km/h which is above the maximum regulatory speed limit in almost all countries. At some stage, limitations on maximum speed of vehicles may need to be considered. However, even such limitations would not solve all the speed problems - especially in urban areas, where limitations on maximum vehicle speed would be of little assistance in ensuring compliance with speed limits of 50 and 30 km/h. In countries where the speed limiters are not compulsory, consideration should be given to mandatory speed limiters for trucks and coaches.

[5]. As an example, in France, the introduction of automatic control sanction system in 2003 contributed to a reduction by 22 % of national road fatalities in 2004.

Conventional cruise control (CCC) and adaptive cruise control (ACC) can help drivers control vehicle speed. Adaptive cruise control – which allows the vehicle to follow a vehicle in front and maintain a pre-selected time gap or headway (distance) is very promising.
Electronic stability control (ESC or ESP) has proven very effective in reducing accident risk –particularly in the case of single vehicle accidents-. The wider introduction of electronic stability control on passenger vehicles should be strongly encouraged.

Event data recorders (EDR) can deliver significant road safety benefits. EDRs can record data elements prior, during, and after an accident, including vehicle speed, acceleration, air bag deployment and some other occupant-based variables. More sophisticated EDR systems that transmit vehicle operational data including speed to fleet management centres are widely used in commercial vehicle fleets, particularly in North America. EDR's can be expected to promote a degree of "self enforcement". Their wider deployment also needs to be encouraged.

Development and progressive implementation of driver assistance and vehicle speed control technologies.

As *new technologies* become available progressively, new applications will provide a logical step forward in speed management. At present, Intelligent Speed Adaptation (ISA) applications are being actively researched in many countries. With ISA technology, the vehicle "knows" the local speed limit and is capable of using that information to give feedback to the driver or limit the vehicle speed.

Two broad ISA categories are being assessed for possible wider deployment:

- *Informative (advisory)* ISA, which principally displays the speed limit and warns (via a sound or a visual element) the driver when above; and
- *Supportive (intervening) ISA*, which provides advice to the driver but is also intervening in the sense that information on the speed limit is directly linked to the vehicle control system, with feedback to the driver.

Both systems can be set voluntarily (the driver chooses to activate it) or be made mandatory (the system is activated all the time). Whatever system is chosen, the driver can always override it in emergency situations.

Given the great potential benefits that such new technologies can bring, progressive implementation is encouraged on a cost-effectiveness basis. Appropriate actions could include:

- All new cars equipped with manually adjustable speed limiters (where the driver can choose the maximum speed)[6], and as soon as practicable with voluntary informative or supportive ISA, to assist drivers to adhere to speed limits (static and eventually variable).
- Reflecting the potential substantial safety benefits, mandatory ISA applications are given further consideration for the longer term, recognising and taking into account the changes in philosophies and liabilities that could be involved (for the supportive systems).
- To help secure the potential benefits of the promising new ISA technologies, governments are encouraged to start developing, in co-operation with relevant

[6]. Adjustable speed limiters are increasingly available on new passenger cars in Europe and Asia. In other regions, notably North America, such devices are currently not well known.

partners, the necessary digital speed limit databases. These databases could well have other uses (e.g. for traffic management).

4. OTHER NEW TECHNOLOGIES

It is recommended not to neglect the development of other new technologies.

For the longer term, there are a number of other technological advances that can be expected to provide real opportunities to greatly reduce the number of collisions, and ultimately the number and severity of casualties. It is of course essential that the impact of technology be fully tested and evaluated in development and in pilot projects on the road network before widespread rollout. As well as optimising their intended road safety benefits this will also identify any potential disadvantages. It is important to guard against the increased use of technology having the contrary impact and compromising safety, especially as such devices become increasingly complex or integrated with others. There will also be other important implications, including training requirements, financial cost and much wider issues, such as liability and social acceptability to overcome "Big Brother" concerns.

Many countries are already actively participating in research into Intelligent Transport Systems (ITS) and Advanced Driver Assistance Systems (ADAS). As an example, the European Commission's e-Safety initiative was launched in April 2002 to co-ordinate these opportunities and seek to accelerate their development and deployment. Nonetheless it is essential that individual countries, and pan-European and world-wide forums continue to research and analyse these emerging opportunities so that informed decisions can to be made at the appropriate time.

The long-term vision is for intelligent highways where individual vehicles and roadside infrastructure communicate using a variety of different media. Bringing together various existing and future systems for the creation of such an intelligent highway would greatly assist drivers. It also opens up wider potential to actively control vehicles from the roadside from which it would be possible to reduce or even eliminate the margin for driver error through, for example, detecting other vehicles and obstacles in close proximity. Ultimately, technology could enable detection of road conditions simply through the level of cohesion between vehicle tyres and the road surface.

The sections below summarise some of these projects.

SASPENCE

SASPENCE is a sub-project programme under the European Commission's Integrated Project PReVENT[7], the main goal of which is to develop and evaluate an innovative system to ensure compliance with the Safe Speed and Safe Distance concept. This concept will be realised and tested in two demonstrator vehicles. The SASPENCE system is conceived to co-operate seamlessly with the driver, suggesting the proper velocity given the actual driving conditions (*i.e.* road condition, traffic density, road geometry, frontal obstacles, potentially dangerous road locations, weather conditions, *etc.*). The system will

[7] The Integrated Project PReVENT is a European automotive industry activity co-funded by the European Commission to contribute to road safety by developing and demonstrating preventive safety applications and technologies.

suggest, and help the driver to keep to, the proper speed and headway, preventing risky and dangerous situations, and thus avoiding collision. SASPENCE will also provide the driver with useful support to lower lateral acceleration on inside curves to avoid potential loss of control of the vehicle.

SafeMAP—Digital information for safer driving

The SafeMAP project in the European Union combines public sector agencies and private sector firms and focuses on six assistance features, namely speed limit assistance, curve warning, intersection warning, overtaking assistance, hazardous area warning and accident spot warning.

Static and dynamic features of the roadway must be integrated into digital maps that then become part of the on-board navigation system provided in the vehicle. Static information includes speed limits, roadway features, geometrics, and so forth. Dynamic information includes accident data, weather conditions, construction work zones, and other data that change with time.

The system can warn drivers when the posted speed limit is exceeded. While the use of a static, digital map can be valuable to the vehicle operator, the combined effect of both static and dynamic information regarding the environment in which the vehicle is travelling will be a powerful application of the ITS technologies observed by the Scan Team. Ultimately, SafeMAP will allow the driver to focus on key decisions that will be made with pertinent and timely information.

Galileo applications

The GALILEO satellite radio navigation system is an initiative launched by the European Union and the European Space Agency. This worldwide system will work in complementarity with the current GPS system. Application to road safety and speed management could include permanent monitoring of a car, or advising when the driver is travelling too fast. It could also warn drivers when they are approaching a bend too fast for example, if associated with a digital speed limit database. The greatest gains could be experienced by specific types of transport, such as the transport of dangerous goods.

Electronic Vehicle Identification (EVI)

EVI is an electronic vehicle plate, developed mainly to identify and find stolen vehicles. EVI allows high-level section control, meaning that it can follow a car for any distance.
With this system, it could also be possible to automatically calculate speeds for each vehicle, and to identify those driving above the speed limit on a section of road (section control) more easily than with current means. The fact that such a system is also useful for identifying stolen vehicles may well be an argument in favour of its introduction.

Identification of driver through digital print recognition

Some systems can recognise drivers based on finger print recognition or face shape recognition. For each driver, several parameters are registered, such as maximum speeds. In practice, it can be used for young drivers and, in the longer term, it could also be used

for repeat offenders (similarly to the use of alcohol interlock systems for repeat drink-driving offenders).

Applications for speed management in tunnels

In tunnels, two informative systems are currently being investigated:

- The “ferret”, a beam located on a roof of the tunnel or on a side wall, that road users can follow in order to comply with speed limits and maintain appropriate distances between vehicles (see figure 2).

- The “illuminated drag”, which emanates (flows) from each vehicle (by the ignition of diodes when a vehicle passes by, at a length which takes into account the vehicle speed and the required safety interval) and which indicates the minimum safety interval to the drivers following behind.

Experiments on these different systems are expected to take place in the future.

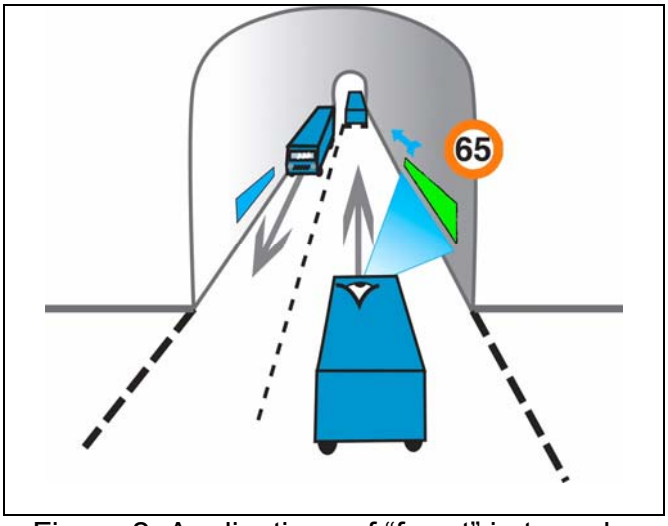

Figure 2: Applications of “ferret” in tunnels,
to guide the drivers on the appropriate speed (Source: Yves Durand Raucher)

French SARI Project - Automatic road condition monitoring

This research project sponsored by the French Government through the PREDIT 3[8] programme aims to increase understanding of how roads influence accidents and investigate how future co-operation between the road and vehicles might use this information to provide drivers and road managers with real-time information; this includes advance warning of potentially hazardous driving conditions or obstacles requiring lower speeds. The expected outcome is to bring about significant reduction in the number of accidents in which drivers leave the road or lose control of their vehicles on rural roads in France.

The SARI programme contains research of a varied nature. The first stage is improving knowledge about the way difficulties on the road affect the behaviour of drivers and vehicles. Other stages will develop techniques to identify and characterise these

[8] PREDIT is the acronym for “Programme de Recherche et D’Innovation dans les Transports terrestres” (*programme of esearch, experimentation and innovation in land transport)*. PREDIT 3 was the third of such programme and covered the period 2002-06.

difficulties (test vehicles) and to develop prototype information systems, and carry out full-scale trials in order to evaluate the effectiveness of implemented systems, in particular how they affect driver behaviour. The programme could also comprise personalised information, taking into account the characteristics of the driver (*e.g*. young drivers). An ergonomic study will also be undertaken to decide on the types of information (factual or interpreted), the type of media (VMS, integrated with the vehicle's navigation system, *etc.*) and the forms of the message (visual, text, audio) that will have the most impact, depending on the nature of the information (strength, frequency, importance).

In summary, the project will provide advice for speed choice, based on the local characteristics of the road, the weather conditions, the type of driver, the type of vehicle, *etc.*

5. IMPLEMENTATION AND LIMITS OF THE RECOMMENDATIONS

The recommendations of the Speed Management working group, the main ones of which are presented above, are clearly not of a compulsory nature. Their objectives are to influence the policies conducted in different countries and, in a more subtle way, to encourage those who are far from these recommended approaches to justify their choices.

The working group brought together experts who are widely-recognised in their fields and from a large number of countries, which adds weight to these recommendations.

It may be necessary to develop a significant point for the reader: although the working group is of the opinion that, one day, it will be necessary to limit the power or maximal speed of the vehicle, or its power-to-weight ratio, this notion is not included in the recommendations for the short term. The working group considered that there would be no impact in urban areas. In addition, the group felt that it would be counter-productive to propose a measure which is currently rejected by one European country.

At the same time, active systems such as ISA/LAVIA should be encouraged. Initially, there could be voluntary systems but, in the longer term, the introduction of compulsory systems should be considered. This means that regard must be paid, at the outset, to the time factor of any ISA project.

Most of the measures presented in this study can be implemented in all countries and in both rural and urban areas. However, where should we start? Perhaps countries with no experience in speed management should focus their efforts in urban areas, where significant safety gains can be quickly obtained, particularly for vulnerable road users.

The group was unanimous in its conviction that there is no magic and sustainable measure. The best approach would be to develop a comprehensive package of speed management measures, including engineering, enforcement and education, tailored for each country based on its road safety performance.

It can be expected that some developing countries may face difficulties in following the group's recommendations, even though we have taken care to adapt our recommendations to the specific situations of these countries

What will become of the recommendations in this report? We hope that they will be adopted by a maximum number of countries. If this were not the case it would be synonymous of a collective schizophrenic behaviour, with one side setting ambitious road safety targets (for example – 50 % in France and in the EU) and the other ignoring the main cause of fatal accidents.

6. CONCLUSION

Reducing speeding will immediately reduce the number of fatalities and injuries and is a guaranteed to make real progress towards the ambitious road safety targets set by OECD/ECMT countries. Co-ordinated actions by the responsible authorities could bring about an immediate and durable response to the problem of speeding.

The report, the main recommendations of which are developed in this paper, is now available in English and French. Extracts of the report will also be published shortly in other languages.

Finally, it should be noted that a comprehensive bibliography is included in the report, to inform the reader of the various areas related to speed.

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