SAFE MOBILITY

An IRF discussion paper

International Road Federation
Fédération Routière Internationale
Federación Internacional de Caminos

(Front cover) Newly developed LANELIGHT LED road markers, enhancing visibility and safety.
Photo: Swarco, Austria

By shielding a hazardous situation, well placed shock absorbent safety barriers can mitigate the consequences of driver error.
Photo: Quixote Transportation Safety, Inc.

INTERNATIONAL ROAD FEDERATION

The International Road Federation (IRF) is the leading global industry support organization

for

advocating, financing, planning, designing, building, maintaining and operating safe, efficient highway and road systems

by providing

support for the development of roads and highways worldwide

through

technology transfer, networking opportunities, and educational and management programs

coupled with

timely advocacy, high-quality market data and effective communications

aimed at

delivering specialized services and programs by region and by country

designed to meet

public and individual membership needs.

The IRF, founded in 1948, is a non-governmental, not-for-profit organization with public and private sector members in some 70 countries.

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PHOTOGRAPHS

3M Deutschland GmbH (Germany)
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Quixote Transportation Systems Inc. (USA)
SWARCO Holding (Austria)

Clear markings protect motorists against ill-perceived situations.
Photo: Swarco

foreword

"Connecting people to resources and opportunities": It is in these terms the World Bank encapsulates the principal social and economic benefit of efficient road networks. It reflects the indispensable role the road plays in the movement of goods and enhancing mobility. Mobility generates jobs and supports national, regional and international trade.

The benefits of roads largely outweigh their negative aspects. Nevertheless, their negative impact cannot be ignored, in particular the costs, in both social and economic terms, of road accidents. IRF deplores the high number of road accidents and urges authorities to analyse their causes and find adequate solutions. Keeping the road as safe as possible while maintaining its major quality – mobility - is the main challenge for policy makers.

Accidents are rarely the result of a single factor. In the vast majority of cases, they result from a series of random incidents and events. It is for this reason that substantial improvements in road safety can be achieved only if all the component parts of the road transport system (RTS) are addressed, i.e. that is, a holistic approach to the interactive triangle of road user, vehicle and road infrastructure. This approach considers all attributes - infrastructure improvements, driver training, vehicle safety performance - to be on a par in the pursuit of greater road safety.

Upgrading road markings, a significant means of enhancing road safety at a reasonable price.
Photo: Compagnie Signature, France

Most work to date has focused on the human element (road user) and vehicle, with decision makers, all too often, assigning responsibility to road users, telling them to reduce speed, wear a seat belt, avoid alcohol, and so on. These certainly valid requirements cannot, however, be the only focus of effort.

For its part, IRF believes that substantial changes must be made to the road infrastructure itself. This document highlights infrastructure improvements that would be beneficial to the safety of all road users.

We have tried to keep the document as succinct as possible. We have not addressed in detail items such as road vehicle development or driver distraction factors (for example, mobile telephones), road user training, education and so on.

(cont.)

Low-cost road markings with increased retroreflection and profiled actions reduce the number of accidents, in particular involving collision with tunnal portals.
Photo: Swarco

Readers requiring more detailed technical information may contact IRF for further details. They can also refer to national standards or, where appropriate, recently developed standards such as those applicable within the European Union.

The document itself was formulated by road safety experts from among IRF membership, representing both public and private sectors, together with a number of partner organizations sharing the same concerns. We would like to take this opportunity to thank them for their important input and commentary.

We now submit the paper to a wider public for reflection and consideration in the belief that it will be warmly received and policy-makers will draw inspiration from its recommendations in their efforts to save lives and reduce suffering from road accidents.

The tyre, interface between vehicle and road. Frequent checks of tyre tread and pressure are vital to ensure vehicle safety.
Photo: Michelin

ROAD TRANSPORT SYSTEM (RTS): COMPOSITION AND DEVELOPMENT

Definitions

Road Transport System (RTS)

An entity composed of three interactive elements: the user, the vehicle and the infrastructure. Their relationship is regulated by a legislative framework. The interaction between the three parties creates a traffic situation.

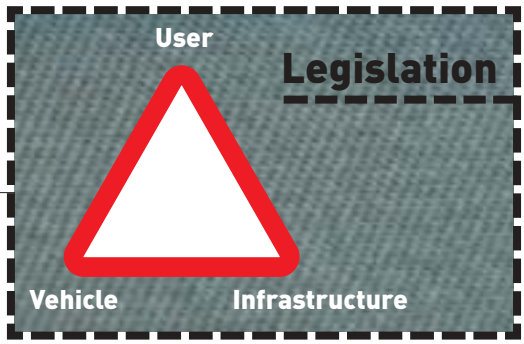


Figure 1:
The road transport system (RTS): an interactive triangle "user-infrastructure-vehicle". Legislation should take all three into account.

User

Not exclusively limited to "protected" road users, such as occupants of cars and public transport vehicles, but includes also "unprotected" road users, such as motorcyclists, moped riders, cyclists and pedestrians.

Road vehicles

Includes both motorised and non-motorised road vehicles.

Road infrastructure

The entire highway network together with its equipment and immediate environment.

Key role of the Road Transport System

To offer safe, efficient mobility, in particular to minimise time and effort in connecting human and organisational demand with existing supply of products and services in society.

Road Transport System: composition and development

In early times, roads were designed and built primarily to meet the needs of rural communities and for commercial and military purposes. With the advent of the motorised road vehicle, the road network was subjected to a use that it had neither been designed for nor adapted to.

Thus, two of the principal elements of the RTS developed independently of each other, with vehicle ownership based on market forces, and roads themselves built by national, regional and local authorities in response to social and economic needs. No system approach, founded on compatibility and interaction was applied. The third element – the road user - was hardly ever considered. (Cont.)

Assigning responsibility: the road user

A general result of RTS development has been assignment of responsibility for road safety to the user, the natural link between road and vehicle. This is reflected in current road and traffic legislation.

Drivers will always make mistakes

Research undertaken over many years confirms that, however well educated and trained, human beings are prone to make errors when at the controls of a vehicle. The errors are of two types: intentional and unintentional.

An intentional error is, for example, non-respect of speed restrictions. An example of non-intentional error might be loss of control of a vehicle through distraction, hazardous highway surface conditions, difficult weather conditions or a combination of such factors.

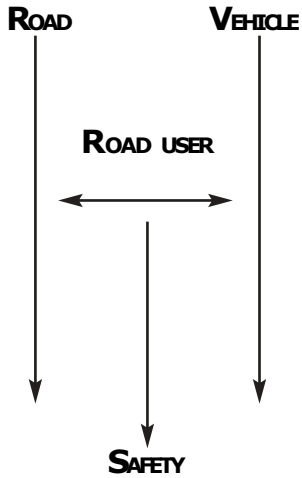


Figure 2: Better road safety means cooperation and understanding between the three principal components of the Road Transport System (RTS)

Cost of accidents

According to current estimates, the number of people dying annually in road accidents may rise to between 1 million and 1.3 million over the next ten to twenty years, with the increase occurring in developing countries and countries in economic transition. According to the World Health Organization (WHO), road traffic accidents will be the third leading cause of disease or injury and the sixth leading cause of death in the world in 2020.

Road accidents generally cost between 1 and 3 % of a country's Gross National Product (GNP). Typically the figure is about 1.0 % of GNP in developing countries, 1.2 % in transition countries and 2.0 % in industrialized countries.Total global economic cost is estimated at about US$ 500 billion per year world-wide*. The European Union estimates the cost of a single road death at EUR 1 million, based on a further life expectancy of 40 years, and associated contribution to society and the economy.

Road casualties generate both direct and indirect costs. Direct costs, which include police, ambulance, hospital, sick leave costs etc. are relatively easy to calculate. Indirect costs, covering loss of productivity and human suffering, are somewhat more difficult to assess.

The vast majority of road deaths occur to the young and those in the prime of life. Road accidents are also a leading cause of head injuries and acquired disability. Care for the disabled largely falls on families and friends. Household income often decreases from the loss of a victim's or carer's earnings. The sudden and unnatural death or disability of a loved one leaves families traumatised.

*** Statistics sources: World Health Organization (WHO) and Global Road Safety Parnterhip (GRSP)**

SAFE MOBILITY

Need for a new approach

Road safety targets, such as the European Union's goal of reducing fatalities by 50% by 2010, require long-term, sustainable solutions, with long-term impact. Nevertheless, long-term solutions for road safety cannot rely entirely on changing driver behaviour. A safe RTS should provide all users maximum protection against human error. True, positive support to the user, such as information, education and training - and negative support, such as penalties – can make a significant contribution. Such passive measures will, however, never be sufficient.

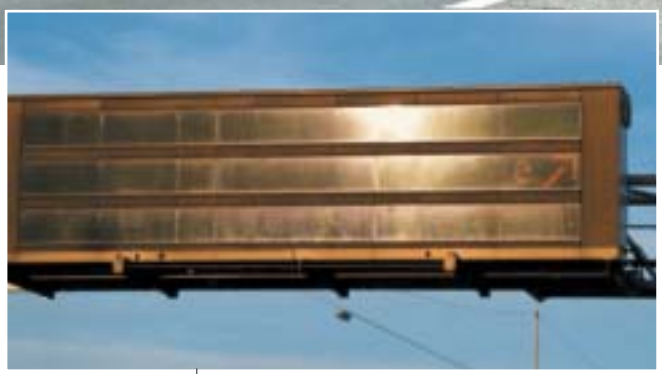
Pro-active road safety measures are needed, supported by an approriate level of funding, and designed to improve the infrastructure and make it more forgiving of human error. Major changes must be made to the road network itself: construction of motorways, bypasses, separated highways, where necessary; an improved level of road maintenance.

In addition, installing and upgrading road equipment such as safety barriers and obstacle protection, markings, signs, signals and lighting make a vital contribution to a reduction in road accidents and the unacceptable burden they impose on society.

This is the thinking behind **Safe Mobility**. Today, it is the cornerstone of IRF's reflections on improvement in road safety.

Safety on winter roads: anti-icing equipment installed in safety barriers.
Photo: Quixote Transportation Systems, Inc., USA

Perfectly readable LED based road information panel. The special optical design (without disturbing front screen) prevents phantom light effects and reflections.
Photo: Swarco



Front screens cause phantom light effects that seriously impair panel readability.
Photo: Swarco

A stretch of road in the Philippines: timely maintenance saves money in the long-term and greatly improves the safety of road infrastructure.
Photo: Egis Projects

GENERAL PRINCIPLES AND RECOMMENDATIONS

Focus on the road user

The three governing principles of Road Transport System design should be: improved mobility of people and goods; better quality of life; enhanced service to users.

Road users, as road taxpayers, are customers. The relationship between road authorities and users should be based on the supplier-customer business model. This relationship should also be reflected in road design, which should take into account the limitations of the road user.

The road user remains entirely responsible for respecting civic obligations and road traffic regulations. Authorities need to look closely at road safety and civic responsibility training from an early age. They must also continue to encourage road safety campaigns, nonetheless remaining aware that such campaigns induce only short-term modifications of behaviour.

The "forgiving" highway

Safe road design, the so-called "forgiving road", minimises the consequences of road user errors and precludes those that might have disastrous consequences. The basic design parameters of road design should be tolerance and resistance of the human body to mechanical forces.

It is extremely important for road designers to take into account the low physical tolerance of the human body and integrate maximum protection for all road users. There should be no rigid stuctures, other dangerous elements, or unprotected zones directly adjacent to a road or highway. Where rigid structures exist, for example on bridges, safety features should be introduced to enhance road user protection. Features such as safety barriers should take into account the needs of all road users. The users of two-wheel vehicles such as bicycles or motorcycles are particularly vulnerable.

Precedents for programming the human error factor into design exist in other industries, for example the nuclear power industry and the aircraft industry, which automatically integrate a series of safeguards. This automatic integration of safeguards should also apply to the road sector.

This means that more responsibility for the structure and safe functioning of the RTS should be shifted to road designers with a view to improving the quality and expanding the capacity of road networks. IRF strongly encourages road authorities to involve experts in human behavioural sciences when designing new roads or modifying existing ones.

Multidisciplinary approach

The Road Transport System (RTS) should be developed and maintained taking into account the interaction between user, vehicle and infrastructure. This means cooperation: between road builder and vehicle manufacturer, and shared information on new developments in each industry, both taking due account of the limitations of the road user.

This level of cooperation proved crucial during the phase-in period of Intelligent Transport Systems. All three industries should now extend this cooperation to research on the protection of vehicle occupants and unprotected road users, such as pedestrians.

Highway design

The highway design adopted must be optimal for the case under consideration. Whilst IRF does not recommend that all trunk roads should be upgraded to motorway standard, it is nevertheless a fact that it is safer to drive on a motorway than on a two-lane or rural road.

High quality safety products

Installing and upgrading road safety features such as appropriate road surfacing, crash barriers, protection against road side obstacles, horizontal markings, vertical signs, delineators, signals and public lighting offer the road user the best possible protection, by using appropriate, high quality road equipment, accessories, materials and features. Equipment used should comply with regulations or, where none exist, to the highest industry standards.

It is the responsibility of the legal authority and designer to ensure that equipment installed is selected according to its ability to protect the road user and not according to price level. All too often contracts are awarded solely on price. It is not the lowest but the best bid that should win. The buyer must have the flexibility to take into account technical advantages and lifecycle costs and an obligation to respect appropriate rather than minimum performance requirements.

IRF believes that basic safety requirements in terms of vision and time response should correspond to those of a senior citizen. See Demographic trends, page 14.

Road funding

Road safety requires an appropriate level of road funding. Safety performance will not be improved if governments continue to siphon off revenues from direct and indirect road taxes to the general treasuries. It is up to policy makers to ensure that adequate funds are dedicated to investment in roads and into road user mobility, education and training.

Funding should also be available for regular maintenance and upgrading to ensure the long-term performance of road safety features. Low-cost safety measures should be encouraged. These are low-cost improvements and low-cost treatments at accident black spots that can bring a major return on investment through a reduction of accidents.
Adequate levels of maintenance funding should apply throughout the entire life-cycle of the infrastructure.

International Cooperation

Efficient road safety concepts should be disseminated to countries in transition and developing countries. Solutions must be carefully adapted to national and local conditions.

ROAD SAFETY POLICY CHECKLIST

Commitment

Governments should assign a high priority to prevention of road traffic deaths and injuries in their policy statements and mobilise resources and political commitment.

Dedicated funding

Governments should develop sustainable funding for road safety through dedicated funds. Highway engineers must be ensured of funding for maintenance during the entire life cycle of the infrastructure.

Sustainable solutions

Priority should be given to long-term sustainable road safety measures carried out in accordance with strict environmental protection principles.

Supportive measures

Road safety and civic responsibility training should be carried out from an early age. Governments must also continue to encourage road safety campaigns, nonetheless remaining aware that such campaigns induce only short-term modifications of behaviour.

Cross border cooperation

Possible confusion in interpretation of road signing should be reduced to a minimum through cross border cooperation and standardization.

Partnerships

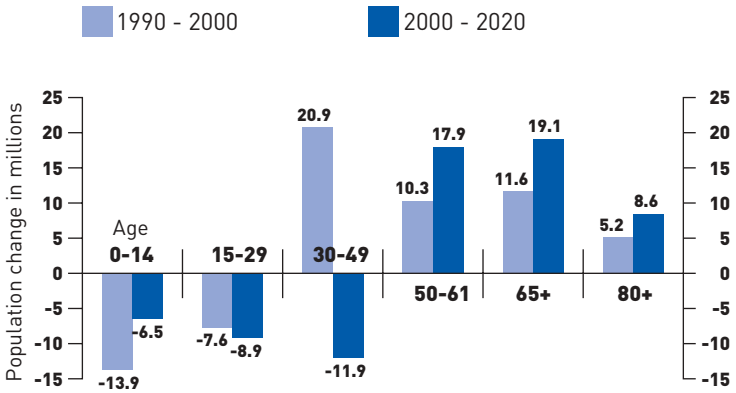
Partnerships must be formed at local, national and international levels to bring together transportation engineers, law enforcement bodies, industrialists and other interested parties such as paramedical emergency services.

Dissemination of know-how

Efficient road safety concepts should be disseminated to countries in policital and economic transition and in developing countries. Solutions must be carefully adapted to national and local conditions.

I. DEMOGRAPHIC TRENDS -
in Europe the population is ageing

Demographic trends by age group in the EU



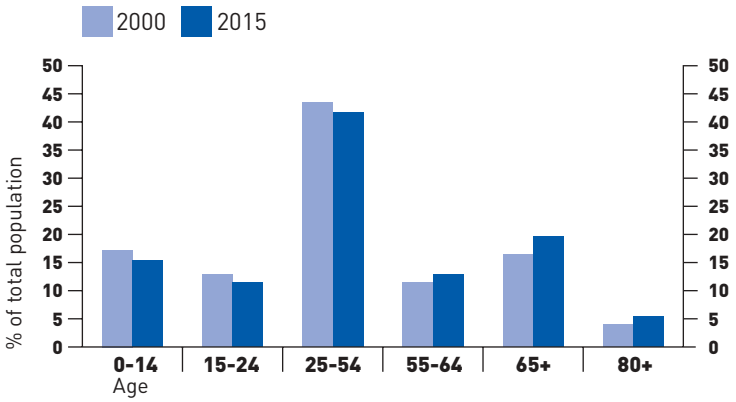
Source: Eurostat - Demographic Statistics and Baseline Scenario

The economic and social impact of population ageing on safe mobility will be particularly pronounced **in the coming decades. Low birth rates combined with increasing** numbers of road users of retirement age will mean that the driver and pedestrian population is getting older.

Population ageing will have important implications for a wide range of public policies, transport, education and health being among the most important.

As the number of road users with impaired vision and reaction is on the increase, there is a great need for strong, high performance message transmission by means of vertical and horizontal signing and lighting equipment.

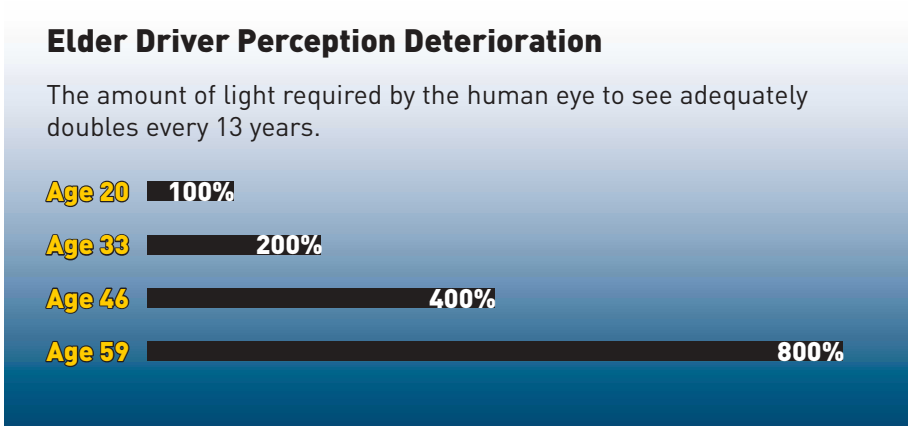
Share of each age group in the total EU population



Source: Eurostat - (2000-based) Baseline Scenario

II. HUMAN FACTORS:
luminance requirements for an ageing population

Source: 3M



Drivers should perceive road signs the same way in day or night-time conditions. Road sign performance must also meet the needs of an ageing population of road users.
Photo: 3M Deutschland GmbH

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