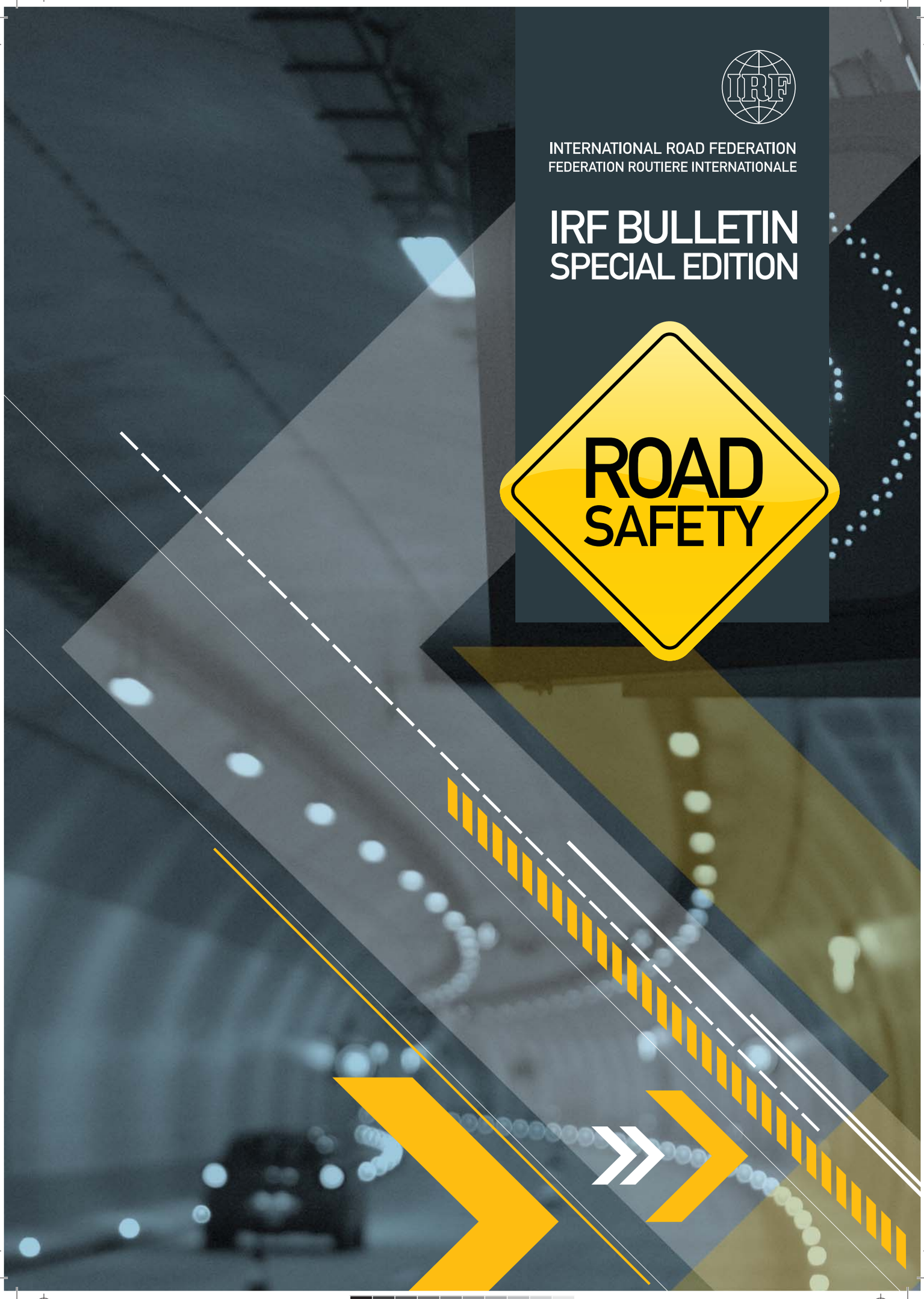

INTERNATIONAL ROAD FEDERATION
FEDERATION ROUTIERE INTERNATIONALE

IRF BULLETIN
SPECIAL EDITION

ROAD SAFETY

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Credits and Acknowledgments

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Graphic Design & Layout: Digitalgrafis Studio, Indonesia

The IRF would like to thank the following for supplying articles, charts, comments and photographs for this publication: Jean Beauverd (Colas Switzerland), Peter J. Boyd (Delcan, Canada), Mike Dreznes (IRF Washington), Rik Nuyttens (3M Europe), Hans-Joachim-Vollpracht (PIARC Technical Committee Road Safety), Elena de la Peña (Spanish Road Association), Richard Harris and Tim Cuell (WSP Group), Dr. Madaniyo Mutabazi (University of the West Indies, Trinidad & Tobago), J.-Pierre Henrat (Colas France), Francis Letaudin and Jean Luc Aubert (SACER), Jean-Claude Roffe (Colas France), Maria Novikov (IRF Geneva).

Publisher:

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Jean Beauverd

Welcome to the second IRF Bulletin Special Edition of 2007.

In the first edition - on the environment - we examined the degree to which current levels of mobility are sustainable, however vital they may be for the world economy in general and isolated communities in particular.

We concluded that they are *not* sustainable if we - and I include the entire road transport sector in my choice of pronoun - ignore the effects of our activities on the natural environment. But we also concluded that there are many things that we are doing, can do and *must* do, for the future, to guarantee sustainable mobility for all.

The same principles apply to our choice of subject for this special edition: road safety. That choice is - if you will excuse the English pun - "no accident." The environment and road safety are uppermost in nearly everyone's mind, when road transport is under discussion. We can assert the economic benefits of the sector as much as we like but those benefits tend to be taken for granted, whether we like it, or not.

What we, the road constructors, must do is concentrate - as the winners of this year's IRF road safety awards have done - on the "four Es" of excellence. As with all worthwhile endeavours, what is needed is collaborative effort between all the players. The search for excellence encompasses aspects of engineering (where road design and road materials used are critical), education, enforcement and encouragement.

That message emerges strongly from the pages of this second special edition of our bulletin.

Jean Beauverd
President and CEO, Colas Switzerland
Chairman of the IRF Geneva Programme Centre

A Word from the IRF World Executive Board Chairman

Peter J. Boyd
Chairman, Advisory Board
Delcan, Toronto, Canada

Road accidents affect all our lives. Road transport is a near-universal activity and none of us remain untouched by its negative physical impacts - be they the trivial effects of a "fender bender" or the tragic consequences of a fatality. If the worldwide toll of road accidents, reliably estimated to be one million deaths per annum, arose from the effects of a medical condition, then the world's news headlines would be dominated by that toll. Undoubtedly, the UN's World Health Organization would take a quantum leap until the condition had been eradicated.

To those that say eradication of fatalities and serious injury is impossible, please consider the words of Robert Browning, "... man's reach must exceed his grasp, or what's a heaven for?" To reach for the goal of eradication is the duty of us all.

Peter J. Boyd

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Introduction

Road Safety Is No Accident - the slogan of the 2007 United Nations Road Safety Week - well describes the problem of road safety. Approximately 1.2m people die annually on the roads; up to 50m are injured. Road accident injuries are the first cause of death worldwide for the 15-19 years age group. Aside from the human tragedy, this has a big economic impact. We know that certain statistics - especially on road injuries - should be treated with caution. But the World Health Organization (WHO) puts the annual cost at $518 billion, globally. These figures call for urgent action.

Each year 1.2 million people are killed in road traffic accidents around the world. Another 50 million people are injured, many suffering life-long disability. Over 85% of road deaths occur in developing countries. The WHO warns that if these trends continue, the number of road accident casualties will increase by 67% from 2000 to 2020, including a jump of 83% in developing countries, making road traffic accidents the third largest cause of injury and sixth largest cause of death.

Following the global recognition of this true world "epidemic" caused by road accidents and the creation, in 2004, of the UN Road Safety Collaboration, governments have responded by conducting road safety campaigns targeted mainly at improving *user* behaviour. Progress in *vehicle safety* has contributed significantly to reducing road deaths and injuries and will continue to do so as requirements become more stringent. But in order to be effective, any comprehensive road safety programme needs to include an *infrastructure* component.

The IRF is the only world forum advocating better and safer roads through better road design. Given its members' rich expertise in road safety engineering measures, IRF is in an ideal position to initiate road safety projects aimed at improved road infrastructure.

IRF Geneva members endorse both lobbying and societal initiatives and support actions aimed at **improving the image of the industry** in the short term *and* benefiting road safety in the long run.

Tarmac Terror

Top causes of death among under-25s worldwide, 2002

Rank	1-4 years	5-9 years	10-14 years	15-19 years	20 - 24 years
1	Lower lung infections	Lower lung infections	Lower lung infections	**Road traffic injuries**	HIV/AIDS
2	Childhood deseases	HIV/AIDS	**Road traffic injuries**	Self inflicted injuries	**Road traffic injuries**
3	Diarrhoeal diseases	**Road traffic injuries**	Drowning	Maternity	Self inflicted injuries
4	Malaria	Childhood deseases	HIV/AIDS	Lower lung infections	Maternity
5	HIV/AIDS	Drowning	Tuberculosis	Interpersonal Violence	Interpersonal Violence

Source: WHO

***Eg: pneumonia, bronchitis**

Safety Matters

Mike Dreznes
Deputy Director General
IRF Safety & Training
IRF Washington

In December 2006, a car carrying two passengers collided with a lamppost on Queens Ride at the junction with Common Road, next to Barnes Common in Hampton, UK. The passengers survived the collision with some injuries. The roundabout where this accident took place was poorly lit, the lamppost was poorly placed and an accident resulted. What was done to fix the problems? Nothing.

A few weeks later, another young man paid with his life when his VW Golf smashed into the same lamppost at the same roundabout. *Both* of these accidents should have *never* happened. Sadly this young man is now just a statistic - among 1.2 million individuals killed on the world's roads around the world every year. This figure is staggering and should make the lack of road safety a global epidemic.

The Transport Research Board (**TRB**) AFB 20 (2) Roadside Safety Subcommittee is addressing some of the international road safety issues that affect us all and are becoming greater concerns everyday as more vehicles are put on the roads. Some of the recent issues included the need for a harmonized method to test and select longitudinal barriers. Currently road authorities use either local standards, which may not be appropriate to today's vehicle fleet, or they have to choose between the NCHRP 350 tested products used in the United States and Australia or the EN1317-2 products used in Europe. The AFB20(2) Subcommittee is working on a concept that would allow either NCHRP 350 or EN1317-2 barriers to be used on projects, giving road authorities more economic options to use state of the art products.

The Subcommittee is also addressing the serious issue of motorcycle interaction with longitudinal barriers - a big problem in countries where motorcycles are a prominent means of transportation. However, last year in the United States, for the first time, more motorcyclists were killed impacting longitudinal barriers than occupants in cars.

Road safety does not begin and end at the roadside. It is a complex issue demanding a comprehensive approach to solving the problem of millions of needless deaths. The IRF is actively working to eliminate the road fatalities on the roads around the world through road safety training seminars. IRF Road Safety Seminars educate road authorities in the design and building of safer roads *and* how to implement safety programs for drivers, including education and enforcement concepts.

To make the roads safer around the world, the IRF is thinking big, and acting small. The message that something needs to be done now has to be loud and clear. The IRF is getting the message out on a global scale through some of the largest organizations in the world while also conducting road safety training seminars to the smallest of audiences. However, getting the message understood is only the beginning. Learning how to change, improve and evolve is what will ultimately save lives.

No person killed on the road is just a statistic. They are mothers and fathers, brothers and sisters, husbands and wives. At the International Road Federation we are fully engaged in contributing to the reduction of road accidents by bringing our expertise to the various stakeholders.

Signing, Road Design and Attention to User Groups

Road safety improvements will be achieved through holistic approaches, covering roads, vehicles and particular users. There follow three examples of these approaches - covering the application of signing in accident black spot management, an analysis of what constitutes the "forgiving road", and a national attempt to help a significant road user group.

Blackspot Management: Low Cost Measures Offered by Horizontal and Vertical Signing

Rik Nuyttens

3M Europe, Traffic Safety Systems

Blackspot situations can be improved dramatically by low cost upgrading of signing and pavement markings. The use of high performance retro-reflective technology in combination with fluorescent colors have demonstrated in various situations that improved conspicuity of the signs and markings have resulted in lower accident rates. This improved visibility is needed around the clock for all kind of weather conditions, for any age of person driving any type of vehicle. More time to see, provides more time to think, decide and act.

The European Union is taking road safety seriously - as they confirmed at the Verona conference in 2003 and 2004. The European Road Safety Action Programme outlines the different focal points and requires a concerted effort on the different road users (education behaviour change, law enforcement), vehicles (vehicle safety, e-safety) and infrastructural investments (black spot eradication, road safety audits, trans-European networks, sign harmonization, tunnel and railroad crossings). The wish for a specific "Infrastructure Directive", confirms the EC commitment in this direction.

Many countries have identified their local blackspots and may have a plan already on how to improve these situations. Many studies on cost/benefit investments are available as well. The same applies, on how to perform road safety audits and inspections, advocated by this "Infrastructure Directive."

The table below shows the cost/benefit evaluation by the Norwegian Transport Economics Institute. It shows that road marking and signing is a very low cost investment - and already pays back for low traffic-use situations, as

Some examples of low cost road safety treatments in Norway. (Source : Rune, Elvik and Rydningen 2002.)

Treatment	Mean Cost (NOK*)	Mean AADT	Cost-benefit ratio
Pedestrian bridge or underpass	5,990,000	8,765	1:2.5
Converting 3-leg junction to roundabout	5,790,000	9,094	1:1.6
Converting 4-leg junction to roundabout	4,160,000	10,432	1:2.2
Removal of roadside obstables	310,000	20,133	1:19.3
Minor improvements (miscellaneous)	5,640,000	3,269	1:1.5
Guard rail along roadside	860,000	10,947	1:10.4
Median guard rail	1,880,000	42,753	1:10.3
Signing of hazardous curves	60,000	1,169	1:3.5
Road lighting	650,000	8,179	1:10.7
Upgrading marked pedestrian crossings	390,000	10,484	1:14.0

*** 1 NOK = 0.138 Euro (December 2002)**

Effect of re-signing - only one accident has occurred since the implementation of the changes.

well. This article focuses on a few best practices that demonstrate this positive impact. It should be noted that the cost benefit situation could vary from country to country.

Blackspot Management in Hungary: With the cooperation of KTI (Hungarian Transport Science Institute), the GRSP Hungary (Global Road Safety Partnership) sponsored the resigning of 3 blackspots among the 200 blackspots identified by the authorities. KTI followed up on the traffic situation. A good example is provided by Route 6219, a road section between Mezöfalva and Sanszentmiklos. The section goes uphill, directly followed by a sharp curve to the left. New traffic signs and pavement tape were provided in March 2001; an additional speed reduction was implemented.

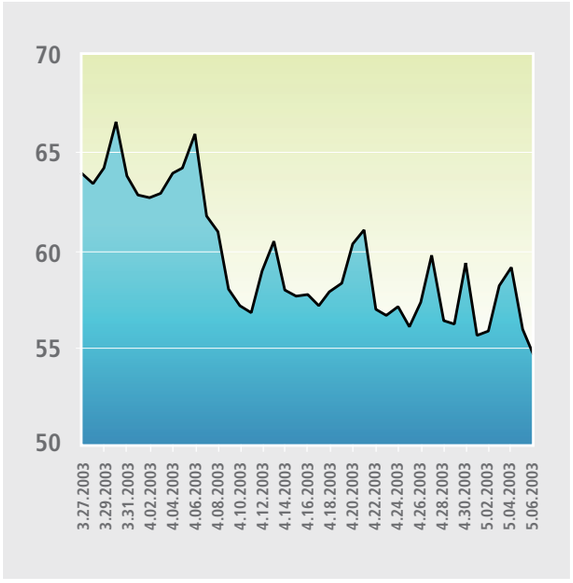
Belgium - Brussels Ring Upgrading

Belgium - Brussels Ring (Vorst/Forest): Work was carried out in September 2000, with a renewal of the pavement, plus pavement marking, Type 2 barriers and vertical signing - Fluorescent Type 3.

The accident rate in August/December 2000 was reduced by 90 %, compared to the same period in 1999. And there was much less damage to the road infrastructure. The pictures on the left show the upgrades

Blackspot Management in the Netherlands: a good example is the installation of a driver feedback System (DFS 130) at Heersch. Work took place during March 27 - July 13, 2003. The problem had been that too many cars were entering the village at too high a speed - 80 km/hr.

The decision was taken to install the "driver feedback sign" 100 metres before the 50 km/hr speed limit started and then monitor driver behavior. Initially the speed was only recorded by the radar built into the sign, with the sign remaining covered. When the sign was uncovered - just after the second speed peak on the chart - an immediate, beneficial, impact on driver behaviour was seen. Average speed dropped from 64 to 58, and later even to 55 km/hr. Also the number of cases of speeding in excess of 80km/hr was reduced from 7% of movements, to 2.8%. Today these types of signs have become popular - to announce school and construction work zones, dangerous curves, or intersections.



Conclusions: why should upgrading to higher performing signs and road marking be encouraged? Various studies have shown that, for safe driving, a preview time of 3 seconds is needed. Many signs and especially road markings are, in fact, "traffic signals" with a decisive impact on driver's safety - mainly because they are non-verbal and, in consequence, readily understood by drivers. In poor lighting or bad weather conditions - only illuminated by headlights - they are one of the most relevant and in many cases, the only, element to guide drivers safely. Most road authorities admit that investing in adequate signing and road markings is one of the best low-cost "returns on road safety investment"available. Recent surveys and international studies also show the need for harmonization in colour, size and symbols.

In terms of road markings, continuous rain retro-reflectivity is available to offer an "all weather" performance. Temporary yellow tape has high night and wet visibility, and can easily be removed without leaving traces after road works have finished. Further, the use of temporary black tape to cover original road markings also avoids confusion for the road users and provides additional safety. In terms of vertical signing, some recently developed microprismatic technology provides improved visibility for all drivers, including truckers, vans and SUVs - where a higher observation angle performance is needed - and older drivers, who need more light to read signs. An aging population and an increased number of trucks on our roads give further impetus to upgrade traffic signs accordingly.

There is a constant rule - **additional time to see, provides additional time to think, decide and act.**

From Roads of Condemnation to Forgiving Roads - How Far to Go?

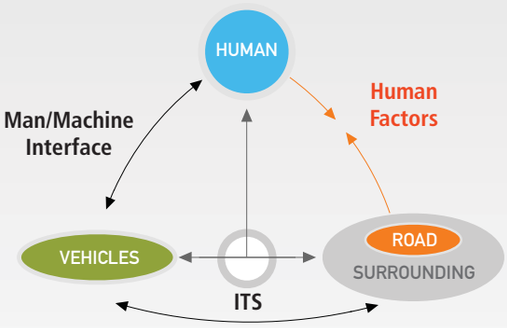
Hans-Joachim Vollpracht
Chairman of the PIARC Technical Committee Road Safety

They call them coffin roads, those national roads in Vietnam newly rehabilitated by development aid. According to the official statistics just 3% of the accidents are caused by infrastructure deficiencies and 90% by human misbehaviour. Condemnation of road users is the usual reaction to road accidents worldwide. The theory is that if 20,000 drivers a day are managing to drive without an accident then the one driver who does have an accident is at fault. But - if we had one severe accident on that road section *every day* - wouldn't that make us mistrust the infrastructure?

During years of accident investigations at black spots we have learned a lot about the interdependences between the layout and equipment of roads and human behaviour. To adapt the technical subsystems of the transport system to our natural abilities and limitations is the proper way to travel, away from condemnation of the road user to an assertion of the user's human rights. But how far away is this goal?

3 elements of the road transport system:

How to Adjust?



Physical factors ($f_r + q = v^2/g*r$) engineering

A lot of research has been done on safe road design, operation and equipment. But the excellent knowledge developed has not been spread wide enough, in emerging and developing countries. *Their* most crucial problem is the mixed function of roads, mixing local with fast long-distance traffic (see picture, above). There is no forgiveness when a driver loses control and leaves the carriageway, or when a child is suddenly running on that carriageway.

It often comes down to what is appropriate, as a road cross-section.

The pictures on the right show 2 x lane cross-sections with wide hard shoulders in an eastern EU country and in East Asia. Both roads are used as narrow 4 x lane roads - and have a high incidence of severe head-on accidents. Remarking to a 2+1 cross-section could reduce accident costs by 40%.

Such cross-sections have been eliminated from the standards of most Western European countries for decades, for road safety reasons. But such cross sections are still constructed and financed by European and other donors - outside Western Europe. Is this the result of balancing the various interests involved, giving costs and transport demands the highest priority, followed by environmental, private or political interests - and only then, the safety aspects?

The following maxims for providing safer roads through road design and operation will not increase the costs for construction and operation:

- The road must guide the user clearly, with no confusion as to the course of the road, or the right of way. **Never mislead the driver!**
- There should be no sudden changes in the course of the road - from link sections to intersections; from interurban to built-up areas; from mono functions to mixed functions. Consequently - **Never surprise the driver!**
- Road users should not have to process several pieces of information within a short time - through seeing more than two different traffic signs in one place; intersections with a high number of conflict points; a quick succession of different road features such as bends, intersections, or bus stops. Thus - **Never overwhelm the driver!**

- There should be no contradictions between the road infrastructure and the traffic rules. If the maximum legal speed is 100 km/h but the design speed is only 80 km/h, most drivers will be unable to detect that it is not safe to drive at the legal speed. And so - **Avoid contradictions!**

- In Western Europe about 25 % of the fatalities are due to run-off accidents with trees, utility poles and other man made road side obstacles. So we can learn a maxim from New Zealand, which is - **Provide error-forgiving road sides!**

In all this, potential and actual deficiencies are detectable by Road Safety Audits in the *design* phases and by regular Road Safety Inspections of *existing* roads. A successful journey to forgiving roads needs a system of information for *all* stakeholders in the road administrations, the ministries, the research and the donor organizations, about best practice in road design and operation, based on knowledge of human factors. National and local road administrations have to be aware of their responsibilities to maintain infrastructure and equipment in the best condition for road safety. Financial donors should build Road Safety Audits into their decision processes, and use the safety potential of better road infrastructure, thus preventing a balancing of the various political and private interests from wasting development aid and jeopardizing human lives.

The Role of the Spanish Road Association in the Improvement of Motorcyclists' Safety Conditions

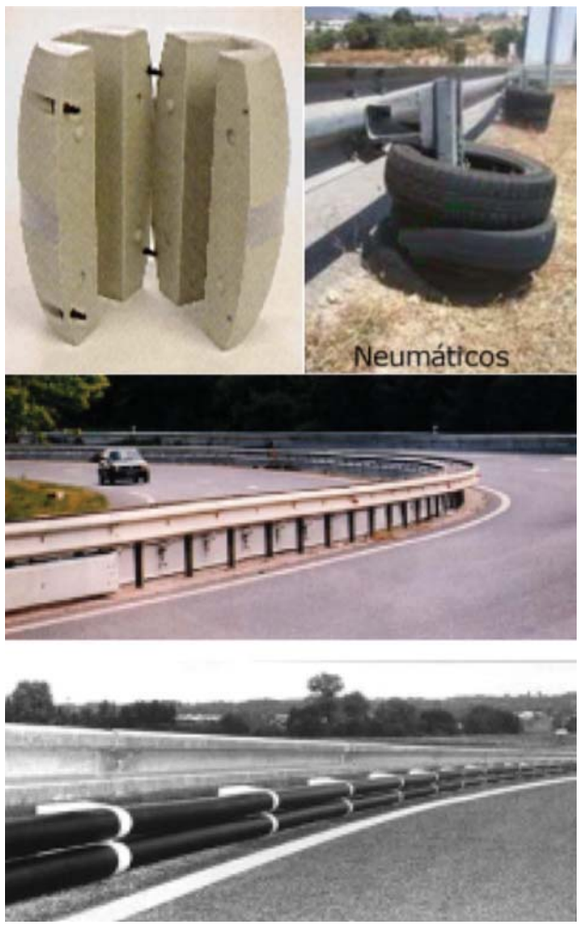
Elena de la Peña
Technical Sub-Director,

The Spanish Road Association (AEC - Asociación Española de la Carretera) is a reference point for road safety at both the national and international level. Throughout the more than fifty years of its existence, and especially during the last twenty years, over a hundred research projects in this field have been conducted, together with seminars, congresses, media contacts and technical committees.

At the end of the nineties and the beginning of this century, there was a great social demand in Spain for the protection of vulnerable road users, in particular motorcyclists. The main concern was the potential danger of safety barriers for them. Guaranteeing the safety requirements of vulnerable road users has always been a priority for AEC.

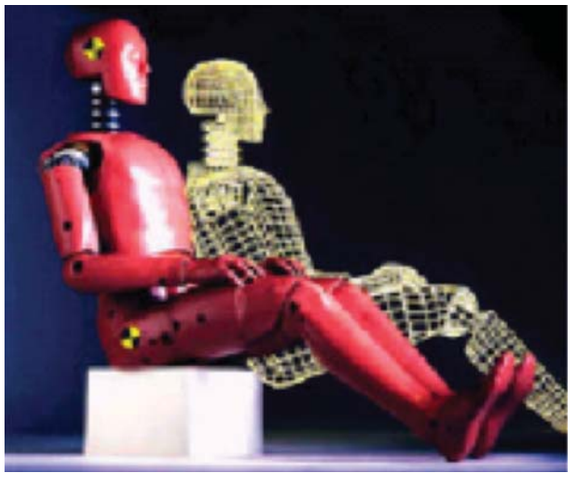
AEC, together with the Road Safety Institute MAPFRE, developed in 2000 a first research project called "Recommendations on designing infrastructures for two-wheeled vehicles", where an analysis of the specific safety problems for motorcyclists in road alignment and equipment were analyzed, and a number of recommendations given. After public demonstrations of the motorcyclists' association in the main Spanish cities, demanding an improvement in safety conditions, and in view of the results of the AEC project, the Spanish authorities decided to act, with safety barriers as a priority area.

The General Road Directorate of the Ministry of Public Works and the General Traffic Directorate of the Ministry of Home Affairs, asked AEC to chair and manage a multi-sectoral working group to develop **a new standard for**



the testing of motorcyclists' protection devices installed in road barriers. Up to that point, several road devices were considered as safe for motorcyclists - but these had not been checked. Three such devices are illustrated above.

The aim of the new standard was to identify which safety characteristics should be demanded, for a specific motorcyclists' protection device to be considered as such. To meet the objective, a number of tests were conducted, measuring the effect of crashes on a dummy motorcyclist.



Members of all sectors involved in the problem of motorcyclists' safety were included in the working group: the Road Administration, standards bodies, test laboratories, safety barrier manufacturers, motorcyclists' protection devices manufacturers, physicians - and users. Several technical meetings were held during 2002-05, in order to develop the standard. During this period, experimental tests were conducted in order to measure theoretical hypotheses against real laboratory results. Finally, in September 2005, the standard was officially approved, and published as regulation **UNE 135900**.

The standard states the conditions under which all tests should be conducted. There are three different tests: post centred, post decentred and vain centred. In all tests, the dummy impacts the safety barrier with an angle of 30 degrees and a speed of 60 km/h. Clearly, each safety barrier which conforms to UN135900 should also conform to **EN UNE 1317**, guaranteeing that safety barriers are appropriate for both light and heavy vehicles.

AEC continues to develop its research - to optimize recommendations for the installation of motorcyclist protection devices. UN135900 is being promoted as a European regulation - because there is a lack of ***European*** standards in this field. AEC feels justifiably proud that its lobbying and research activity has helped improve motorcyclists' safety conditions.

Excerpt of the publication 'Guidelines for PTW-Safer Road Design in Europe'

Published by the Motorcycle Industry in Europe ACEM in April 2006 (www.acembike.org)

Design of an obstacle-free zone

The vulnerability of the motorcyclist asks for the design of an obstacle-free zone next to the road. It is essential to minimize the number of obstacles especially in high speed bends. The supports should not have jagged or sharp edges, nor have any protrusions that might hurt a fallen motorcyclist. On highways the path of the motorcyclist leaning into bends must be considered; a factor that is of no concern to four-wheeled vehicles. The dimension of the obstacle-free zone is related to the design speed of the road. Dimensions of the obstacle-free zone vary in individual countries. In France for instance the obstacle-free zone is 4 meters for newly constructed roads.

Avoid erecting road safety barriers if alternative measures suffice

Removing hazardous obstacles often provides greater safety to road users than a safety rail.

Place safety barrier away from the edge of the roadway

Placing a safety barrier is a matter of careful consideration. A motorcyclist who topples over or falls off his Powered-Two-Wheeler (PTW) will normally continue in the direction of travel. The PTW seldom ends up far from the edge of the road; therefore it is important to keep the first few meters from the edge free of fixed obstacles.

Use of PTW-safe road safety barrier systems

The use of a PTW-friendly safety barrier system should be considered in places, for example in bends, where motorcyclists will be most at risk. The general principle of a PTW-friendly safety barrier is to protect the fallen motorcyclist from jutting support posts. These PTW-friendly safety systems may be newly installed or fitted on existing barriers. Other possibilities are using round posts instead of those with sharp edges or using crash barrier protection.

Intelligent Transport Systems

Much has been heard in recent years of Intelligent Transport Systems - ITS. Some of the literature suggests that future road safety will involve major decisions being taken out of the hands of the road user and that technology itself will provide the answers. It is perhaps more useful to consider Traffic Management Systems - of which ITS provide some components - as the following article shows.

Improved Road Safety Through Traffic Management Systems

Richard Harris, Director
Tim Cuell, Director
WSP Group

" Improving road safety contributes to all areas of improving transportation. Road safety is not an optional extra, but an absolutely fundamental requirement "

Increased economic activity increases transport demand for both individuals and the goods they produce and consume. To maintain and improve the efficient operation of the transport network as demand increases, accidents need to be both minimised and, once they occur, quickly detected and resolved. As we try to squeeze more capacity out of our networks, the effects of any disruption increase as delays and congestion quickly build up. The policy challenge is to determine whether to intervene with traffic control measures and how best to achieve the desired results.

While many cities and regions have implemented traffic control to improve network performance and to balance competing demands, others are actually *removing* equipment to force drivers to take more responsibility for their own behaviour. Indeed in Drachten, the Netherlands, sixteen junctions formerly controlled by traffic signals now operate without any indication of who has priority, while two other junctions have been converted to roundabouts with the same non-priority status.

However, intervention is now more widely used to help achieve policy objectives. Traffic management and traffic control and information improve safety and can reduce the severity of accidents. They can better distribute traffic across the network and help balance demand. They can be used to prevent, or to recover and correct imbalances.

Intelligent Transport Systems provide powerful tools for helping achieve policy objectives. From data collection, incident detection, information exchange, traffic management systems, rapid response teams, information provision and on-board, in vehicle, driver support systems, through to compliance encouragement and automatic enforcement, ITS is helping to save lives on our roads. Indeed, the European White paper - European Transport Policy for 2010 - makes a clear link between ITS and safety, declaring that "Only 6% of road accidents appear to be unavoidable and beyond the reach of improved technology".

Some examples of ITS benefits regarding road safety include:

- Installing signalling warning systems on very busy motorways - which shows a decrease in the number of accidents by up to 50% while also achieving a 5% increase in capacity;
- Displaying estimated "travel times" was valued information for drivers and received excellent satisfaction rates (by more than 90% of drivers

questioned) and notable reductions in "driving stress" (by more than 65% of drivers questioned).

- ITS extensively deployed in France shows an impressive 25% reduction in the number of accidents, largely due to automated speed enforcement.

- Thanks to ITS measures the safety in Alpine tunnels has been greatly improved

The automatic enforcement system deployed in France has had a more fundamental effect on driver behaviour. Not only did the number of accidents fall, but general driver compliance increased significantly. However, it is interesting to note that the number of accidents has started to gradually increase following the dramatic early reductions. This may be due to the reduction in the successful education and promotion campaign that accompanied the introduction of the new systems. A renewed campaign may now be required to raise awareness again.

When it comes to in-vehicle systems major advances have been made in recent years. The introduction of route guidance systems tend to encourage drivers to make better route choice, reducing distances travelled and helping to reduce uncertainty and confusion. Other in-vehicle systems and services are gradually being introduced by motor manufacturers as factory fit options, or as standard features of new models. These will increasingly have an impact on how our road networks operate and how vehicles interact. Advanced driver support systems and cooperative vehicle highway systems that influence the direction and speed of vehicles and how they interact with each other and the road infrastructure include:

- Adaptive Cruise Control
- Intelligent Speed Adaptation
- Collision Warning and Avoidance
- Lane Departure Warning
- Electronic Tow Bar
- Stop and Go
- Priority Operations
- Autonomous vehicles
- May Day eCall
- ISA Variable Speed Adaptation
- Lane Keeping
- Intelligent Platooning
- Intelligent Merging

A common feature of all of these developments is the need for different agencies to cooperate, modify their operating procedures and to adapt to the new responsibilities and opportunities that deployment brings.

A debate on how road operators and motor manufacturers and communications companies work together to help maximise the benefits and minimise problems of such developments is urgently needed. WSP as members of the IRF and PIARC are committed to help this dialogue achieve positive outcomes for all involved in transportation.

Conditions can sometimes be extremely challenging.

WSP is an international multidisciplinary consulting engineering company with more than 8,000 professionals worldwide. We are very much aware of the importance of improving safety within our transport networks. We understand travel behaviour, transport and traffic and the underlying social trends that determine how we live our lives and the importance of safe transportation. We specialise in helping policy makers achieve their objectives and harness technology in the form of intelligent transport systems to help achieve these. We believe in evaluating the impacts of any new system, to both test the business case assumptions and to help lock in benefits to enable decision-makers to determine how best to allocate them.

A View from a Less-Developed Country

It is a common view that less-developed countries share common problems which place them so far down the "league table" of world road safety that an unbridgeable gap must remain, in terms of ameliorating the situation. The following article shows that the same analytical methods as in highly-developed countries may be applied and the same paths followed in order to bring about real road safety improvements.

Evaluation of a New Zebra Crossing in Trinidad

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Walking is the most widely used everyday transport mode. It is healthier and more environmentally friendly than alternative modes. However, in developing countries including Trinidad & Tobago (T&T), pedestrians are vulnerable road users for various reasons. In T&T pedestrians constitute some 50% of all road fatalities and 40% of all road injuries. "Pedestrian crossing the roadway" is the frequently reported scenario in official accounts.

A widely used conventional zebra crossing consists of transverse white pavement markings across the roadway. Such a design suffers, typically, from drivers' low yield rates to pedestrians. Engineers have been searching for innovative ways to supplement zebra markings in order to increase driver yield rates. The government of T&T intoduced a new type pedestrian zebra crossing in 2004 which will eventually totally replace the conventional crossings.
The new crossing is made up of:

- Conventional zebra strip paint markings intended to define the location
- Longitudinal zigzag lines intended to restict overtaking and parking
- Two circular amber signal wigwags, flashing continuously, mounted on white & black striped poles

Flashing lights are intended to supplement zebra strips, making the crossing visible in cases of awkward horizontal and vertical alignment on the approaches. They also serve to define a crossing when pavement markings have faded, or when resurfacing has taken place but re-marking has not been completed.

Evaluation was done through a survey questionnaire administered to drivers and field observation of drivers' behaviour at crossings, in a cross-section study involving a control group and an experimental group. A questionnaire survey was conducted, to test drivers' understanding. Field visits were made to supplement questionnaire information. Information on drivers' behaviour was collected at 23 crossings on a two-lane, two-way road. It involved recording the actions of 1,630 drivers - in the categories "stop", "slow", "no action", when a pedestrian was present. In addition, vehicle type - small, medium, large, and ownership - private, hire, transport firm, were recorded.

The public are appreciative of the project to improve road safety. Some 40% of respondents knew personally a pedestrian involved in a road collision. Some 80% think that a new crossing will improve pedestrian safety. Nearly 90% of drivers understand the significance of the flashing lights. But only 1% identified the significance of the zigzag lines and, during field visits, vehicles were frequently seen parked within crossing limits.

There is a significant difference between drivers' understanding of the *meaning* of zebra markings and drivers' *obligations* at zebra crossings, and drivers' actual behaviour at the crossings. Whilst more than 90% believe they are required to stop for pedestrians and more than 80% understand that the markings *mean* "stop", only about 15% of drivers were observed actually stopping. The corresponding percentages for "slowing down" were 7, 14 and 65 respectively, while those for "do nothing" were 1, 3 and 21 respectively.

Flashing lights were associated with increased driver yield rates in all three categories of vehicle type, vehicle ownership, and pedestrians' direction of walking. However - **educating drivers may increase the effectiveness of the new type of crossing.**

A Word from the Materials & Equipment Makers

Development of road materials and equipment that are "fit for purpose" has been a steady and continuous process for over a century. Developments will continue - with increasing emphasis on products that are an integral part of safer and better roads. Here, some leading producers showcase their wares - and the reasons behind them.

COLGRIP Towards Greater Safety

J-Pierre Henrat
Service Technique de Colas, France

With advanced skid-resistance linked to the use of high-grade artificial aggregates, providing a very rough surface in all weathers and particularly in rainy conditions, COLGRIP is a high-tech road safety system. It is particularly appropriate in the case of road "blackspots", known to be the cause of numerous accidents involving road users and pedestrians.

It reduces braking distances by as much as 40% on wet roads. It therefore avoids loss of control on difficult stretches of road such as tight turns and motorway access. It also provides enhanced efficiency under emergency braking when approaching pedestrian crossings and dangerous roundabouts.

Measured using the transverse friction coefficient (C.F.T.) with LRPC of Lyon's SCRIM apparatus, grip is substantially greater than that of other asphalt surfaces. C.F.T.s around 0.9 are very high and well above those of the traditional values recorded. COLGRIP'S composition means this performance is stable over time.

The thin coating is made up, firstly, of an epoxy composite bituminous binder - content between 1.4 and 1.8 kg/m², depending on the type of base support - and, secondly, a 1-3 mm gravel made from calcinated bauxite with very high mechanical resistance. Depending on the surface to be treated, the binder can be applied using either a purpose-built spreader, a spray gun - for work surfaces of less than 1,000 m² - or manually, with a scraper, for small areas. Calcinated bauxite is laid using a purpose-built spreader, specially designed for this small grading, and by over-chipping. When the binder polymerisation reaction is complete, the excess gravel is swept and aspirated. The return to traffic depends on the ambient temperature and that of the base support. It takes about 3 hours at 20°C.

Projects completed over recent years in France and England guarantee the durability of the surface characteristics, regardless of the traffic or speed. In addition to its grip qualities, COLGRIP is a very quiet surface thanks to its low grading size of 1-3 mm. Furthermore, it offers good resistance to accidental hydrocarbon spills, due to the nature of its binder.

Developed at the Colas Campus for Science and Techniques in Magny les Hameaux, the COLGRIP binder also takes environmental concerns into account. Several sites have undergone accident monitoring over a number of years. Applying COLGRIP at these difficult locations has clearly demonstrated an immediate and long-lasting reduction, or even elimination, of loss of control and accidents. The benefit for local authorities of a "zero" accident rate on a stretch of road known to cause accidents is substantial, easily justifying the application cost of COLGRIP.

Bituminous Mix with High and Lasting Skid Resistance: MICROGRIP by SACER

Francis Letaudin & Jean Luc Aubert
SACER (COLAS Group)

The skid resistance of a traffic lane wearing course is an important parameter for users' safety. Studies on tyre-to-wet-roadway friction showed that the tyre-road contact zone has to be brought back to a "dried" state, in order to regain an effective level of skid resistance.

Regardless of driving behaviour or vehicle condition, the carriageway surfacing plays a role in that process through the action of an indissociable coupling of the bituminous mix design, on the one hand, and the aggregates angularity and intrinsic characteristics, on the other hand. The first one creates a suitable macrotexture to drain water off the road, while the second brings a microtexture able to break through the residual water film in order to "dry" the contact. These actions must be durably effective.

A suitable answer to the problem is provided by the bituminous mixes MICROGRIP and MICROGRIP S by SACER, an asphalt concrete family with optimized design ultra thin (BBUM) or very thin (BBTM) type 0/8 mm designs, which present a higher macrotexture than the usually employed (EN 13108-1) asphalt concrete do.

Their composition, containing small range aggregates, allows a significant increase in the number of tyre-surface

contact points. Moreover, the specific nature of the aggregates itself ensures the preservation and regeneration of these points. Uniquely, these bituminous mixes include a proportion of correcting aggregates which, depending on the traffic, can be of a softer or harder standardized aggregates matrix. MICROGRIP uses softer aggregates, which are generally mono or polyminerals capable of regenerating themselves by the removal of particles, thus allowing the conservation of a PSV level higher than 56. The harder aggregates used in the MICROGRIP S are generally extremely hard and angular, natural or artificial aggregates, with a higher than 62 PSV.

On-site measurements, after several years in service, demonstrate the accuracy of a durable and high adherence technical principle, *regenerated* for the MICROGRIP bituminous mix (certified by the road innovation Charter) and *maintained* for the patented bituminous mix MICROGRIP S. The mean texture depth values range from 0.8 to 1 mm, the braking force coefficient at 90 km/h (CFL90) is higher than 0.40 and the coefficient of transverse friction (CFT) maintains itself between 0.60 or 0.70 depending on the process. Moreover, very low noise levels are achieved.

We have seen, systematically, that these bituminous mixes used on high-accident sectors can render them completely safe. Results obtained are comparable with those achieved with a high-adherence surface dressing, but at an obviously lower cost.

IMAGE, The Revolutionary Mutlticriteria Tool for Road Audits

Jean-Claude Roffe
Colas SA

As road audits become compulsory in Europe, in order to assist all road owners in that vital but huge task, L2m Ingenierie, a subsidiary of SOMARO - a COLAS Group company - has developed a unique equipment consisting of a van equipped with cameras and proprietary software. IMAGE can measure the position of any kind of road equipment and make a real inventory with a user friendly acquisition mode. This acquisition is made at a speed up to 90km/h, a rate of one high definition picture every 3 metres.

The positioning of the vehicle is made in real time, through four sensors. All data are available in x, y, z coordinates - through GPS and its attached gyroscope. IMAGE provides high performance for the road owner. Data can be linked to the customer's Geographical Information System. One of the main applications is to look at the conformity of road marking. IMAGE can ascertain visibility distances according to accepted standards. It offers unique productivity compared to manual systems, and is error proof. This can be important in potential fatal accident litigation.

IMAGE was developed in 2004 and is continually upgraded. The latest development includes 360° pictures. A qualified team of road engineers with an advanced IT work station prepares data to individual customer requirements.

For more information on IMAGE visit our website **www.l2m-ingenierie.com.**

Safety Equipment for Road & Town

Sodirel, France

SODIREL has been involved in the trade and design of Road Safety Equipment for more than 25 years. Located near Avignon in the South of France, SODIREL offers a wide range of road safety products - such as lane separators, bollards, delineators and anti-glare devices. The company is well known as the market leader in the field of crash attenuators.

SODIREL has its own design capability and is ISO 9001 accredited. Its know-how is expanding from Europe throughout Asia. It is renowned for its direct and close cooperation with customers and for its concern for end users' specific requirements.

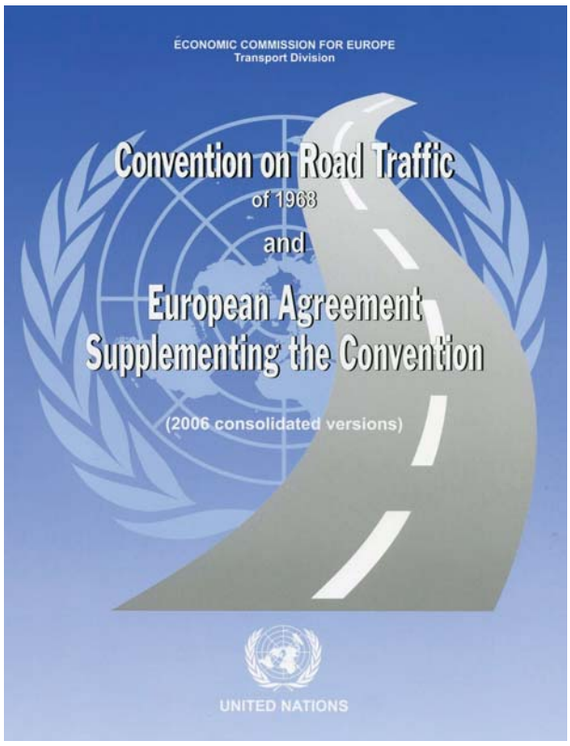
One of its latest projects is in Casablanca, Morocco, with the renewal of Boulevard d'Anfa, one of the oldest streets of the town, equipped with hundreds of VELOCITE lane separators. To cope with traffic of 30-50 thousand vehicles a day, VELOCITE was the suitable solution to separate 2 x 2 lanes and, at the same time, enable emergency vehicles to drive over it. Another site in northen Morocco was looking for cycle lane markers. SODIREL supplied VELOCITE in green and blue versions - the customer's choice.

Why VELOCITE ? Because the surface mounted kerb system actually provides a physical but non- aggressive barrier between cyclists and other road users. The product is supplied complete with PVC strips and optional glass reflectors for night visibility. SODIREL takes care also of the environment and VELOCITE is manufactured from recycled rubber. It is easy to install by using a combination of resin and anchor bolts.

SODIREL is a subsidiary of SOMARO (a Colas Group company), the French leader in road safety equipment. For more information visit our website **www.somaro.fr.**

Why The Broken Line?

Road Traffic and the United Nations



An efficient road traffic system starts with a set of regulations for the construction of roads, the manufacturing of vehicles and traffic on the roads. The **United Nations Commission for Europe (UNECE)** has been elaborating legal instruments governing road traffic since its creation in 1947. Twice a year the UNECE secretariat holds sessions of the Working Party on Road Traffic Safety, also known as WP.1, at the Palais des Nations in Geneva, where governmental and private sector experts meet to develop harmonised rules that constitute the legal and technical basis for national highway codes in many countries around the world. WP.1 is the only permanent working body dealing with road safety within the United Nations system and the legal instruments developed there are applied globally. The IRF, granted a special consultative status by the UN Economic and Social Council in 1951, has been working since then in close collaboration with the WP.1 and with other intergovernmental and non-governmental organisations on harmonising road traffic signs and regulations to achieve safe and smooth mobility on the roads worldwide.

The two most important basic legal instruments developed by WP.1, aimed at facilitating international traffic and increasing road safety, are the 1968 Convention on Road Traffic and the 1968 Convention on Road Signs and Signals, often referred to as the 'Vienna Conventions' - where they were adopted.

The Convention on Road Traffic contains the basic rules for road traffic, including those to be respected by vehicles and drivers. It also provides for the mutual recognition of driver's licences and vehicle registration certificates issued in accordance with the Convention.

The Convention on Road Signs and Signals establishes a set of over 200 harmonised road signs and signals, lays down the rules for traffic lights, signs for road works and level crossings with railways, and road surface markings.

Both these Conventions have global scope and have been supplemented by European Agreements which set additional road safety requirements for European countries.

The Vienna Conventions and the European Agreements underwent multiple amendments since they first entered into force, mostly to reflect technological advances and improve road safety. For instance, new provisions have been introduced concerning issues such as the use of mobile phones while driving, cycle lanes and cycle tracks, the use of lit, retroreflective and fluorescent signs and of variable message signs, and safety in tunnels.

To facilitate the use of the Conventions and Agreements, and encourage those countries which have not yet acceded to the Conventions to do so, the UNECE secretariat is preparing consolidated versions of the revised texts.

The consolidated versions of the Convention on Road Traffic and the European Agreement, the list of Contracting Parties thereto and the list of distinguishing signs used on vehicles in international traffic were released in May 2007 and can be downloaded from **http://www.unece.org/trans/conventn/legalinst.html#rts.**

A hard copy, which includes a historical background, the declarations and reservations made by Contracting Parties to the Convention and an alphabetical index, can be ordered from **http://www.unece.org/trans/roadsafe/wp1publication.html#road_traffic_conv.**

The release of a similar publication containing the Convention on Road Signs and Signals and the European Agreement is expected by the end of 2007.

International Road Federation
Fédération Routière Internationale
Federación Internacional de Carreteras

IRF POLICY STATEMENT

IRF Road Safety Policy

Context and Stakes

According to the World Health Organization (WHO), road traffic crashes will be the third largest cause of disease or injury and the sixth largest cause of death in the world in 2020. 50 million people are injured and 1.2 million killed on the world's roads each year, more than 85% of them in developing countries. If current trends continue, the number of people killed and injured on the world's roads will rise by more than 60% between 2000 and 2020.

IRF's Position and Recommendations

IRF Road Safety Policy

The IRF has been striving for decades to meet the challenge of reducing death and injuries caused by road crashes around the world. IRF membership offers a wide scope of expertise that covers subjects in practically all fields of road development, maintenance and use.

Proven road financing that are experienced world wide by IRF membership strongly advocate the urgent necessity of adapting national, regional and local road networks to the highest possible road safety standards.

Its recent **Policy Paper on Safe Mobility**, describes the principles of road design and equipment discusses ways and means to reduce the risks of serious injuries and deaths resulting from crashes on roads around the world. The main points raised in this paper are based on the policy of the "Vision Zero" concept, built around the Swedish experience.

As one of the first signatories of the **European Road Safety Charter** in Dublin in April 2004 IRF policies in road safety are based on the following elements:

- Road safety auditing
- Promotion of the "forgiving road"
- Offering new construction technologies
- Low cost road safety measures
- Sharing experience and technology
- Offering a non-profit platform for exchange of information between stakeholders, authorities and politicians.
- Providing education and training to authorities and engineers
- Encouraging the installation of high performance road signing and safety equipment.

IRF Policy Challenges

The challenge of this broad policy is the promotion of acknowledged good/best practices. IRF offers the most acceptable level possible of the inevitable burden of vehicle crash consequences and human suffering, in particular:

- the severity of crash injuries
- damage to property
- a maximum reduction of road crash costs to society.

IRF Road Safety Activities

IRF policy is to collaborate closely with international, government and non-government bodies and organisations in order to promote the road aspects in the three objects involved in road crashes, namely the human element, the vehicle and the road.

In 2004 it established a permanent body to coordinate and enhance its role in promoting safe mobility through the worldwide improvement of roads.

As in the past decades, Members will continue to represent the IRF and offer specific expertise in the global international discussions at Road Transport and Safety Expert meetings in the UN, the European Union and in the Americas. This will be accomplished in the best possible coordinated way between the different Programme Centres.

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A Line of Thinking Drivers Can Really Follow

3M™ All Weather Paint

Winner of the International Road Federation's 2007 Global Road Achievement Award for Technology, Equipment & Manufacturing

Driving on rainy nights is a difficult task. Roads become slick and lane lines can virtually "disappear" when wet. It's dangerous, too. Drivers are three times more likely to be involved in an accident during rainy or wet pavement conditions.[1]

Help give drivers the added guidance they need. 3M™ All Weather Markings include unique technology that makes them highly visible—day or night, rain or shine. Now that's a line of thinking drivers can really follow.

To learn more about 3M's turnkey service solutions and high-performance traffic safety products, visit us at *3M.com/tss* or contact your 3M representative.

[1]FHWA-RD-99-130, December 1999

3M

IRF

16th International Road Federation World Road Meeting 2009

May 31 - June 4, 2009 - Lisbon, Portugal

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