GOVERNMENT STATUS REPORT – AUSTRALIA

Robert Hogan
General Manager, Vehicle Safety Standards
Department of Infrastructure and Transport
AUSTRALIA

STATUS OF SAFETY PROBLEMS AND TRENDS

General progress

Australia has achieved substantial reductions in road crash fatalities over the last 30 years, despite a 50 per cent growth in population and a two-fold increase in registered motor vehicles. Between 1980 and 2010, the nation's annual road fatality rate declined from 22.3 to 6.1 deaths per 100,000 people.

The chart below shows the progressive reduction in fatality numbers over that period.

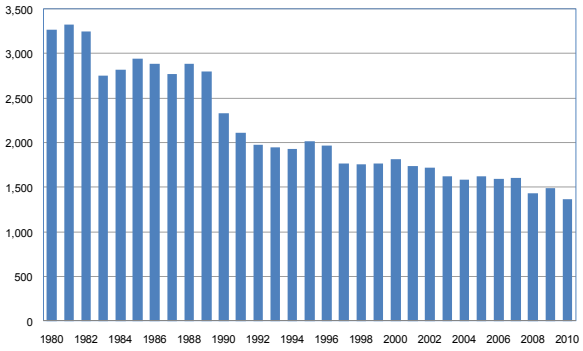


Figure 1. Annual number of Australian road deaths

Trends in Australian road trauma have been characterised by short periods of rapid decrease – large downward steps – followed by longer periods of consolidation and incremental improvement.

Evaluation of evidence indicates that many of these gains can be attributed to specific road safety interventions, some of which have been big and bold enough (such as the introduction of seatbelt laws, random breath testing and occupant protection) to fundamentally change the road safety landscape.

However, the rate of progress has been relatively slow in recent years. Between 2005 and 2010, the average annual reduction in road fatality numbers was 3.3 per cent. Hospital admissions data also point to little, if any, national improvement in the number of people who were seriously injured in road crashes.

National Road Safety Strategy 2001–2010

In November 2000, Australia's transport Ministers endorsed the *National Road Safety Strategy 2001–2010*. The strategy provided a framework for prioritising the road safety activities of federal, state, territory and local governments, as well as other organisations that could influence road safety outcomes. Its target was to reduce the annual road fatality rate by at least 40 per cent over the 10-year period to the end of 2010: from 9.3 deaths to no more than 5.6 deaths per 100,000 population.

Despite significant gains over the decade, the 40 per cent reduction target was not reached (see Figure 2). By the end of 2010 an actual reduction of 34 per cent had been achieved and the fatality rate stood at 6.1 deaths per 100,000 population – some way short of the 5.6 target.

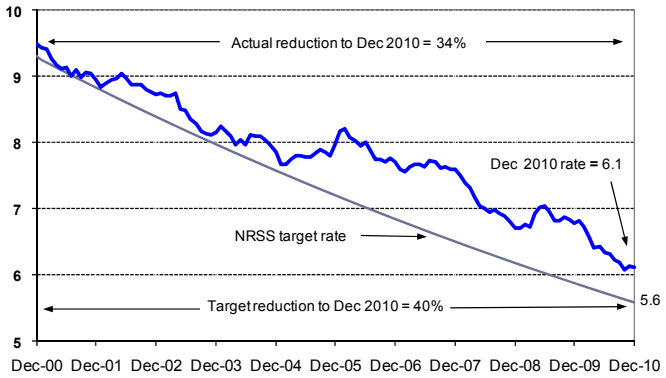


Figure 2. Australian Road Fatality Rate, 2000 to 2010

Note: based on a moving 12-month calculation

Road deaths

Vehicle occupants constitute the large majority of road deaths in Australia, although there are also large numbers of motorcyclist and pedestrian fatalities.

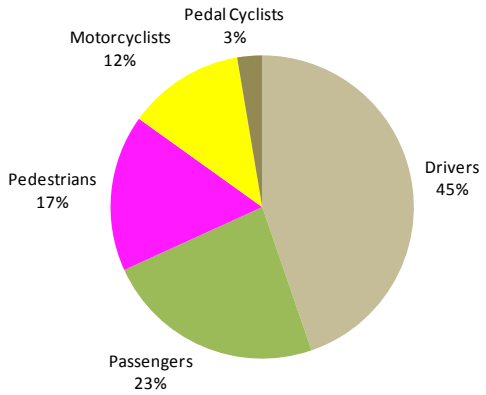


Figure 3. Australian Road Fatalities 2009

There has been significant fluctuation in the number of multiple vehicle occupant fatalities, single vehicle occupant fatalities and pedestrian fatalities across years. However, there has been a clear upward trend in the percentage of fatalities occurring in single vehicle crashes in the last decade.

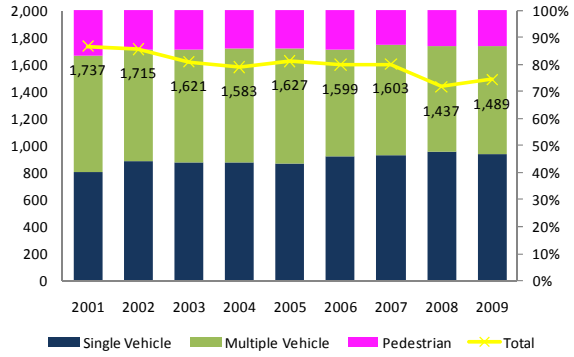


Figure 4. Australian Road Fatalities 2001-2009

National Road Safety Strategy 2011–2020

The Australian Transport Council (comprising federal, state and territory transport Ministers) has agreed to establish a new National Road Safety Strategy for the period 2011 to 2020. The new strategy is expected to set an ambitious long-term vision for road safety improvement, supported by national targets for reductions in the number of deaths and serious injuries over the decade.

On 1 December 2010, a draft of the new strategy was released for a period of public consultation, which ended on 18 February 2011. The draft strategy was developed by senior road safety officials from all Australian jurisdictions and was informed by research and modelling work undertaken by the Monash University Accident Research Centre (MUARC):

- It proposed targets of a 30 per cent reduction in the annual numbers of both deaths and serious injuries by the end of 2020.
- It included a wide range of interventions grouped into the categories of: safe roads, safe speeds, safe vehicles and safe people reflecting a "Safe System" approach.

During the public consultation period, nearly 700 submissions were received from peak industry bodies, road safety interest groups and members of the general public. A revised version of the strategy is now being prepared and is expected to be considered by transport Ministers for approval and release in May 2011.

The consultation draft of the strategy can be accessed from: <*www.infrastructure.gov.au*>. It contains detailed statistical analysis of the road safety situation in Australia.

Australia's ESV presentation will update progress on the strategy.

FUTURE RESEARCH IN FINDING SOLUTIONS TO THE SAFETY PROBLEMS IDENTIFIED

Innovative Research Ideas and Emphasis – Pole Side Impact

In recent years, over 20% of all Australian road fatalities have occurred in side impacts.

- Half of these fatalities have resulted from impacts with narrow objects, principally poles and trees (pole side impacts).
- The experience of a number of other countries with side impacts is similar.

There is current variation in pole side impact crash tests (regulation in the US; NCAP testing in some other countries) and concerns over the biofidelity and injury measurement capabilities of the crash dummies being used.

Australia believes the current progress on WorldSID provides a unique opportunity to improve the international crash test regime for pole side impacts. It also believes that a pole side impact standard is likely to produce significant benefits for other side impacts by driving improvements in head protection and may also have some benefits in stopping ejections in rollovers.

Accordingly it proposed development of a Global Technical Regulation on Pole Side Impact (PSI GTR) at the June 2010 meeting of the World Forum for Harmonization of Vehicle Regulations (WP.29). WP.29 endorsed this proposal and Australia is currently chairing an Informal Group of contracting parties and industry representatives.

The Informal Group is developing a safety need case, taking account of the impact of Electronic Stability Control (which is reducing pole side and rollover crashes), and assessing the merits of various crash tests procedures.

Australia conducted a series of pole side impact crash tests in 2010 in support of the PSI GTR, which are reported in the proceedings of this ESV conference. This research effort is continuing and a further series of tests will be conducted in co-operation with Transport Canada in mid 2011.

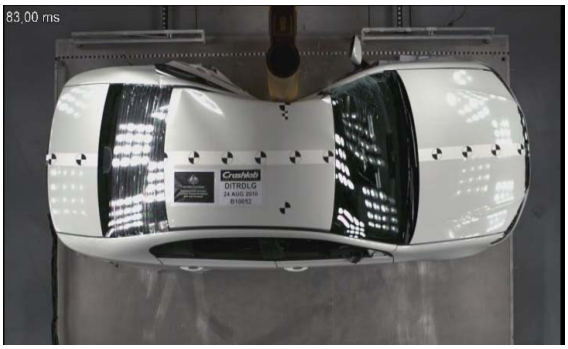


Figure 5. Australian Pole Side Impact Testing

Australia is also commissioning further data analysis in support of the PSI GTR proposal. This is intended to include further detailed analysis of domestic data and relevant international data.

New approaches being tried – improved consultation and increased emphasis on non-regulatory measures

The federal government sets standards for new and used imported vehicles entering the Australian markets. These standards are being harmonised with the regulations developed by WP.29, where practical. However, as in service vehicle standards are regulated in Australia by state and territory governments, cooperative and collaborative approaches to vehicle safety regulation are essential.

Australia, like many other countries, is also placing increased emphasis on non-regulatory interventions including consumer information programs, purchasing guidelines and codes of practice. These measures complement the existing regulatory activity and provide encouragement for the early supply of safer vehicles with leading edge technologies.

During 2010, the Australian Motor Vehicle Certification Board, a forum including federal and state and territory road transport agencies was reconstituted with a focus on whole of vehicle life regulation, particularly in relation to safety. The Strategic Vehicle Safety and Environment Group (SVSEG) was also formed, including federal, state and territory road transport agencies and vehicle industry and community organisations, to consider regulatory and non-regulatory options for improving vehicle safety and environmental performance. One of SVSEG's key roles is to provide direction and coordination for vehicle safety research activities in Australia.

In May 2010 the Australian Government became a member of the Australasian New Car Assessment Program (ANCAP) and is now represented on ANCAP's Board of Directors. The Government is providing funding for a significant expansion of the ANCAP test program and for research into use of results from NCAPs in other countries to rate vehicles in Australia. This will increase the percentage of the vehicle fleet for which an ANCAP safety rating is available.

In Feburary 2011 ANCAP released a Road Map for 2011 to 2015. This document provides for a steady increase in the requirements to achieve each safety rating as well as building additional tests into the overall rating. The roadmap will encourage manufacturers to fit a range of "Safety Assist Technologies", both optional and mandatory for particular star ratings. The new ratings systems will also include minimum results for pedestrian impact, roof crush and whiplash prevention within the overall star rating.

Research on Advanced Technologies – IVART

Together with state and territory agencies, the federal Department of Infrastructure and Transport has participated in the In-Vehicle and At-Roadside Technologies (IVART) Project managed by the Queensland Government. This has included a number of project streams including sponsorship of research such as:

- *"*Analysis of crash data to determine benefits associated with emerging vehicle technology" – identifying likely beneficial technologies for promotion and/or intervention.
- "Cost Benefit Analysis for Intelligent Speed Assist (ISA)" A study of the benefits of introducing Intelligent Speed Adaptation (ISA) in the Australian context considering the type of ISA, vehicle and driver.
- "Capability of Radio Frequency Identification (RFID) for vehicle identification and speed detection". - investigating whether RFID could be used in conjunction with speed cameras to identify speeding motorcycles.
- "Heavy Vehicle Stability Safety Technologies" - identified by the first study above as likely to provide a positive road safety outcome, this study looks in greater detail at new technologies to prevent heavy vehicle roll-over crashes and whether government intervention is warranted. Completion is due in due July 2011.

IVART has also developed a national policy and technology framework document to provide the foundation for government to work closely in partnership with stakeholders in implementing guiding principles that can be applied to the assessment and future deployment of new vehicle safety technologies. It includes strategic priorities and recommendations to move forward.

PUTTING SAFETY TECHNOLOGIES TO WORK

There are three main areas in which vehicle safety technologies are being put to work in Australia:

- Australia is harmonising and will continue to harmonise with international vehicle regulations developed under WP.29, wherever practical. Active safety technology will increasingly come to the fore in these regulations, but it will also be important to ensure approaches to passive safety take full advantage of technological developments and design initiatives.
- As mentioned, ANCAP's Road Map established an approach that will encourage uptake of the latest vehicle safety technology.
- Australia is also engaged actively in technology development and in this regard it is particularly worth noting a trial of Intelligent Speed Adaptation (ISA) conducted in 2010 by the New South Wales (NSW) Centre for Road Safety.
  - Results from the trial indicate that ISA is an effective tool to reduce speeding. When ISA was installed, 89% of vehicles (94 out of 106) reduced the amount of time they spent exceeding the speed limit compared to pre-fitment.
  - Modelling suggests that if all vehicles in the NSW fleet were equipped with the advisory ISA system trialled, then road deaths would be reduced by 8.4% and the number of people injured would be reduced by 5.9%.
  - On this basis, the NSW Government has committed to installing ISA in the NSW Road Transport Authority's fleet of vehicles and to commence the development of an integrated electronic logbook with ISA.
  - NSW is also involved with other jurisdictions in a project called ISA Connect, which aims to develop a national speed zone mapping and management system so that ISA can reliably operate on all Australian roads.

IDEAS FOR POTENTIAL COLLABORATIVE RESEARCH INTERNATIONALLY

Australia remains committed to sharing of international research in support of harmonised international vehicle standards and improvements in vehicle safety.

The current collaborative work being undertaken on WorldSID provides a model for work to proceed on a particular issue. However, it also desirable to further develop cooperative structures for research that can function on an on-going basis and provide advice on priority issues.

In the context of developing a GTR on Pole Side Impact, we have commissioned research drawing on mass data bases in Australia, as well as seeking to utilise international data wherever possible.

This has highlighted the primacy of having good quality data as soon as possible on key issues.

We see significant value in current efforts to establish systems for meta analysis drawing on mass and in-depth data in a number of countries. This allows much earlier evaluation of the

effectiveness of new technologies than could be undertaken in single countries.

This is particularly important, as a major challenge facing all parties with an interest in vehicle safety, is the proliferation of new technologies and other vehicle safety initiatives. Whether these provide benefits and, if so, the scale of those benefits are critical questions for regulation and promotion in non-regulatory approaches.

CONCLUSIONS

There have been significant road safety gains in Australia in the period 2001-10.

A draft National Road Safety Strategy for 2011-20 has been circulated for public comment and a final document is currently being prepared for consideration by Australian Transport Ministers.

The Strategy embodies a "Safe System" approach and it will be crucial for improvements in vehicle safety to make a strong contribution in reducing the road toll over the next 10 years.

Australia is committed to WP.29 processes and the development and adoption of international vehicle regulations where practical and is sponsoring development of a Global Technical Regulation on Pole Side Impact.

Non-regulatory approaches are also a key factor in vehicle safety in Australia with manufacturers, fleet managers, research institutions, industry and consumer organisations all having roles to play.

Advances in vehicle technology and design will provide major benefits, but also present major challenges in ensuring the right technologies are mandated and/or or promoted.

This emphasises the need for collaborative research and for meta-analysis, so that the success of innovations can be identified as soon as possible.

ESV 2011 GOVERNMENT OF CANADA STATUS REPORT

Kash Ram

Transport Canada

Canada

ABSTRACT

This report presents the Canadian road safety situation and describes the programs, research and regulatory activities of Transport Canada since the previous report presented at ESV in 2007. Canada has actively pursued policy initiatives to improve the safety of Canadians and has participated in numerous international research and regulatory working groups to advance motor vehicle safety and road safety.

Transport Canada is committed to on-going collaboration with industry, foreign governments, provincial and territorial governments and stakeholders.

CANADIAN ROAD SAFETY SITUATION

In Canada, road safety is a responsibility that is shared among the federal and provincial/territorial governments. The federal government is primarily responsible for the safety of new vehicles and inter-provincial commercial carriers, while the provincial/territorial governments have jurisdiction over the operation and maintenance of motor vehicles, road infrastructure and the development and implementation of road safety programs.

Like many other developed countries, Canada's road safety record improved greatly during the past quarter century. During this period, fatalities resulting from motor vehicle traffic collisions decreased by approximately 50%, while Canada's population not only grew by approximately 30% but also became more mobile, as the number of licensed drivers grew by approximately 50%. The population of Canada was estimated as approximately 34 million in 2010. Road fatalities in 2009 were approximately 2,200 and statistics for 2010 will be available in the near future. Detailed statistics for 2008 are reported at: http://www.tc.gc.ca/eng/roadsafety/tp-tp3322-2008-1144.htm

Canada's Road Safety Strategy 2015

Canada's new road safety initiative, called Road Safety Strategy 2015, intends to build on the success of the two previous national road safety plans.. The new strategy, which became effective in January 2011, retained a number of the key attributes of its predecessors, including the long term vision of having the safest roads in the world. In addition, the core strategic objectives of the previous road safety plans - raising public awareness and commitment to road safety, improving communication, collaboration and cooperation among all stakeholders, enhancing enforcement and improving road safety information in support of research and evaluation – were also retained.

Characteristics of Road Safety Strategy 2015 that set it apart from Canada's previous national road safety plans include:

- The flexibility afforded jurisdictional (provincial and territorial) partners to develop their own unique road safety plans
- The holistic nature of the current strategy that emphasizes the benefits of adopting coordinated strategies that make roads, vehicles and road users safer and aims to move the current strategy more towards a safer systems type of framework
- The absence of hard quantitative targets at the national level, thereby enabling jurisdictions to determine their desired level of road safety effort. However, progress will still be measured at the national level using rate-bases indices. In addition, jurisdictions can still adopt hard targets should they wish to do so
- A framework of proven effective best practices that jurisdictions can adopt to address key target groups and contributing factors that are frequently cited among fatally or seriously injured crash victims.
- A fluid framework that is regularly updated with new best practice strategies throughout its five-year duration

Some of the key initiatives that have been carried out recently in selected Canadian jurisdictions to make road travel safer included:

- Conducting national seat belt use surveys to identify and target specific problem areas and groups (e.g. young male drivers, pickup trucks, rural roads); national surveys on proper use of child seats for young children; removing exemptions and increasing fines and demerit points for non-users of seat belts.
- Conducting drug and alcohol use surveys among night-time drivers; drinking-driving campaigns targeting youth or young males that raise the awareness of the consequences of drinking and driving and; mandatory assessment/rehabilitation and alcohol ignition interlock programs; the introduction of tougher sanctions for first-time offenders; and research into the use of designated drivers in rural areas.
- Conducting a pilot study that used positive reinforcement to decrease the incidence of aggressive driving and speeding; apilot study on the use of fixed speed cameras; introduced legislation aimed at reducing speeds in construction zones or when passing emergency vehicles or tow trucks; tougher sanctions (fines, demerit point and license suspensions) for speeding violations; expanded red-light camera programs to enhance intersection safety; educating the general public about proper road use practices at roundabouts and the installation of transverse rumble strips at high-risk intersections and on road edges..
- Introducing speed governors on heavy goods vehicles that limit vehicle speeds to 105 km/h.
- Introducing graduated licensing programs covering more than 95% of novice drivers in Canada that require novice drivers to adhere to a number of restrictions before they receive full driving privileges; developing public awareness campaigns targeting youth that focused on the dangers to young drivers and others of driving at unsafe speeds, drinking and driving and non-use of seat belts.
- Pedestrian and driver awareness campaigns reminding each road user of their respective responsibilities; tougher licensing requirements for operators of motor scooters and motor-assisted bicycles; and audits at city intersections to identify existing and potential safety issues, particularly with regard to pedestrians and cyclists.

The findings of the 2007 mid-term review of Canada's previous national road safety plan led jurisdictional road safety partners to carry out focused strategies and interventions that were supported by heightened police enforcement campaigns targeting non-use of seat belts, drinking and driving and speeding/aggressive driving. These focused efforts combined with the downturn in economic conditions contributed to substantial decreases in fatalities and serious injuries during 2008 and 2009, in particular. 2010 casualty results are not yet available. The numbers of road users killed and seriously injured in crashes during 2007-2009 period were 16.5% and 19.8% lower, respectively, than comparable figures during the 1996-2001 comparison periods.

Canada currently ranks 10th among Organisation for Economic Cooperation and Development member countries when comparisons are made on a deaths per billion vehicle kilometres traveled basis (2009 figures).

COLLISION DATA

Collision investigations

A program of in-depth collision investigations is carried out by six contracted research teams across Canada, and by Transport Canada staff located in the National Capital Region. The work supports the Directorate's research and regulatory development programs, actively monitors high-profile traffic safety incidents across Canada, and provides a mechanism for rapid response to such incidents.

Current activities include directed studies focused on several safety issues, and a program of special collision investigations which captures incidents of interest that fall outside of the criteria for particular directed studies. On-going directed studies are investigations of frontal air bag deployments involving vehicles built to comply with the provisions of the current Federal Motor Vehicle Safety Standard (CMVSS) 208 - Occupant Crash Protection, moderately severe vehicle to vehicle side impacts, vehicle to pole side impacts, vehicle rollover collisions with side air bag and/or side curtain deployment, and frontal collisions involving fully restrained rear seat occupants. Special collision investigation topics include school bus and motor coach and 15 passenger van crashes, air bag or seat belt induced fatal and serious injuries, collisions involving event data recorders, collisions between pedestrians and heavy freight vehicles, and the performance of child restraints.

Transport Canada completed the final phase of a pilot study investigating the causes of fatal motor vehicle

collisions. A total of 378 fatal collisions were documented in the study database. This study involves compilation of data on human, vehicle and environmental factors. Work is currently underway to establish an overview of the major causal factors. The results will provide the Department with unique insight into fatal collisions and evaluate the potential of a variety of countermeasures.

INTERNATIONAL ROAD RESEARCH

Transport Canada has participated for many years in the OECD Road Transport Research Program now known as the Joint OECD/ECMT Transport Research Centre. Recent research initiatives by the JTRC include Drugs and Driving: Detection and Deterrence and an upcoming report on Pedestrian Safety and Urban Space and Health.

The Drugs and Driving report indicates that while drug impaired driving shares some commonalities with alcohol impaired driving, there are also substantive differences to the extent that a separate stream of research, policy development and enforcement should be pursued specific to the issue. The report stresses that drugs and driving is a complex issue that requires more research into the impacts of specific drugs, testing protocols and technologies and harmonization of testing procedures and an accepted list of drugs of interest are required. Additional support will be required for enforcement personnel to specifically address the drugs and driving challenge. This challenge includes more than illicit or controlled substances and should include all drugs that impair a driver's ability to safely operate a motor vehicle.

CRASHWORTHINESS RESEARCH

The Crashworthiness Research Division of the Road Safety and Motor Vehicle Regulation Directorate is mandated to reduce the number of Canadians injured or killed in traffic-related crashes by providing the necessary scientific basis for the development of regulatory initiatives. The research programs are directed towards improving frontal impact protection and side impact protection for adult and child occupants and towards the advancement of anthropometric test devices (ATDs) used in the evaluation of occupant protection.

Frontal Crash Protection

The frontal crash test program continues to focus on examining dummy kinematic and thoracic responses as a function of ATD size, vehicle seat position, seat track location, and test speed.

A summary of the frontal protection study and the key findings are presented in "Kinematic and Thoracic Response of the 5TH Percentile HYBRID III" of the 2011 ESV proceedings.

Child protection in motor vehicles and school buses continues to be a high priority for Transport Canada. Child dummies representing 12-month-old, 3-year-old, 6-year-old and 10-year-old children are tested in the rear seats of vehicles undergoing frontal and side impact crash tests. The child dummies are restrained in age appropriate child restraints or booster seats to investigate the performance of the restraints in the vehicle environment. Results of the on-going studies are available on the Transport Canada website http://www.tc.gc.ca/eng/roadsafety/safedrivers-childsafety-programs-regulations-research-research-887.htm

Transport Canada has recently completed a study investigating the dynamic loads of lower and upper anchorages (LATCH) for child restraints with upper weight limits above 40lbs. The findings, which were presented at the Government Industry Meetings in January 2011, indicate that the top tether shares up to 37% of the total load. The maximum loads recorded at each of the lower anchors during full frontal rigid barrier crash tests were all below 8kN. The results of a study investigating infant seat interactions with the interiors of vehicles undergoing full frontal crash tests will be presented and published in the 2011 ESV Proceedings (Paper 11-0406).

A comprehensive study of school bus occupant protection was completed in May 2010. The study reviewed school bus accident investigations conducted between 1992 and 2010 and included crash and sled tests. Compartmentalization was found to be effective in protecting children in frontal impacts but was not effective in severe side impacts, rollovers or events where there was significant vertical lift of the occupant compartment.

Side Impact Crash Protection

The International Harmonized Research Activities (IHRA) Side Impact Working Group had, prior to its termination, proposed two test configurations, one car-to-pole and one barrier-to-car test (ESV 2005). Transport Canada continues to actively support regulatory harmonization through its research programs and international working group activities.

A study comparing the capabilities of ES-2re and WorldSID with and without multi-point sensing technology in oblique pole tests of matched vehicles is underway. The WorldSID male, WorldSID female world harmonized side impact dummies and the Q-series 3 and 6-year-old child dummies are being used extensively in both struck side and far side lateral impacts to better understand the effects that crash

configurations, occupant to occupant interactions and the presence of countermeasures, including child restraints may have on the protection of all occupants in a motor vehicle.

A subcommittee, led by Transport Canada was established in 2005 to develop a new seating procedure for WorldSID male. The procedure, which has now been finalized, was developed in collaboration with representatives from Asia-Pacific, Europe and the U.S. and is the first seating procedure to be based on the world vehicle fleet. Efforts will now be redirected to develop a complementary seating procedure for the WorldSID female.

Dummy Development

The RibEye multi-sensor technology, originally developed for Transport Canada by Denton ATD (now Humanetics) and Boxboro Systems for the Hybrid III 5th percentile dummy has since been successfully introduced into the WorldSID male dummy. The optical technology makes it possible to track the displacement of each WorldSID rib in each of the principal axes providing valuable insight into the kinematic response of the chest during a side impact crash.

Improvements in Test Capabilities

Transport Canada's 30 year old crash laboratory located at the Motor Vehicle Test Centre in Blainville, Quebec has just undergone a major modernization, funded through the Federal Economic Action Plan. The facility, designed to serve Canadians and the motor vehicle safety community for the next 30 years includes:

- A new enclosed 232m main track twinned with a 100m track to conduct moving car to moving car frontal crash tests;
- A new 100m perpendicular track together with an adjustable surface mounted oblique track to conduct moving car to moving car side impact crashes at a variety of angles;
- A new structure to enclose the side impact crash pad, equipped with a dedicated control station and lighting system; and
- A new building to house the future vulnerable road user laboratory.

The success of this project would not have been possible without the expertise and dedication of our operator of the Centre, PMG Technologies, Inc. and our international research partners who welcomed us into their crash labs and so patiently answered all our questions.

Future Work

A new study to investigate and visually describe the consequences of child restraint misuse is currently underway and will continue for the next three years.

An important co-operative program to be undertaken by Transport Canada and the Australian Department of Infrastructure and Transport has been initiated to provide technical support for the development of the new Global Technical Regulation for Pole Impacts. Testing will take place at Transport Canada's Motor Vehicle Test Center and will include motor vehicles from the world market.

HUMAN FACTORS AND CRASH AVOIDANCE RESEARCH

The Human Factors and Crash Avoidance Research Division of the Road Safety and Motor Vehicle Regulation Directorate is mandated to reduce the number of Canadians injured or killed in traffic-related crashes by providing the necessary scientific basis for the development of regulatory initiatives to prevent crashes.

Evaluation of Collision Mitigation Systems (CMS)

Since 2008, Transport Canada has been reviewing the potential benefit of CMS in Canada. In addition to analyzing national collision data to assess the number of crashes where CMS could have provided some benefit, a technical evaluation of collision mitigation systems available in passenger cars in Canada was undertaken. A balloon car and a mobile target were developed and used in the evaluation of the performance of the CMS on commercially available systems (see Figure 1).

Results of preliminary analyses are being shared with ISO TC 204 WG 14 to assist in the development of ISO 22839 (Forward Vehicle Collision Mitigation Systems). Most of the test procedures identified at this stage of the development have been used in full-size testing.

Figure 1. Mitigation braking test with mobile target

Speed Management

A four-month field operational trial was undertaken to investigate the impact of influencing driving speed choice and behaviour through a reward-based process rather than the usual enforcement/punishment-based practice. Drivers were rewarded for not exceeding the speed limit and maintaining an appropriate following distance to the vehicle in front. These two criteria were measured continuously through the use of a Global Positioning System/Geographic Information System (GPS/GIS), an on-board digital speed limit map, and forward-looking radar. Continuous feedback was provided to the driver by an in-vehicle display. Figure 2 illustrates the Safemiles device and display. The display in the figure indicates the driver is compliant with both the posted speed limit and time headway. Points were accrued when both criteria were met for a period of 15 seconds. The participant used the points accumulated to purchase rewards. Results indicate that rewards are effective in influencing driver speed choice, at least in the short term. Compliance rates for both speed and following distance increased from the baseline to the feedback and reward period but dropped off in the post-baseline period although not to the same level as the initial baseline. This is consistent with the results from a similar trial conducted in the Netherlands.

Driver's Field-of-View Study

Vehicle pillars can vary considerably by position, angle, and size. They can create blind spots to the extent of completely obscuring approaching vehicles and pedestrians on the road. Currently, there is insufficient data and understanding of the implications these factors have for visibility and crash avoidance. Transport Canada is conducting a study to evaluate the extent and impact of field-of-view obstruction from pillars in light duty vehicles. Measurements have indicated that there is significant variation in driver view obstructions present amongst different vehicle models and is worth investigating further. Data analysis is looking at the possible link between driver blind spots and collision risk. A variety of new vehicle models are currently being measured.

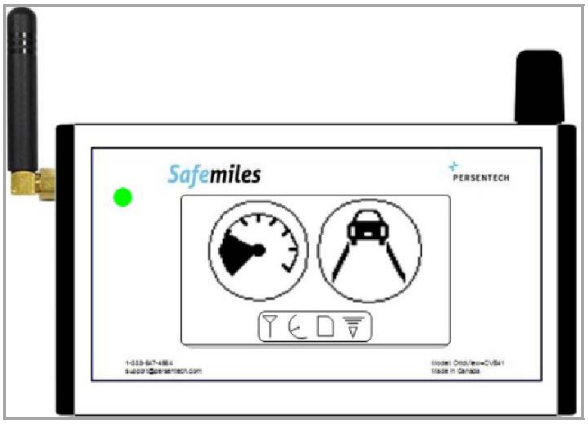


Figure 2. Illustration of Safemiles display.

Methodologies for the Design & Evaluation of Driver-Vehicle Interfaces

The problem of driver distraction continues to be a major road safety concern. In April 2010, NHTSA launched its Driver Distraction Program in an effort to address the safety challenges presented by driver distraction. Transport Canada plans to continue collaborating with NHTSA and other stakeholders to develop distraction metrics and driver-vehicle interface guidelines.

Considerable research activity in both North America and Europe is currently focused on producing protocols for assessing the distraction potential of in-vehicle tasks and devices. Of particular interest are methodologies that are capable of assessing distraction arising from the use of speech-based technologies as much of the work to this point has been directed to visual-manual sources of distraction.

Transport Canada continues to work in this area building on previous efforts to assess the sensitivity, reliability and applicability of proposed testing methodologies. Working with international partners in North America and Europe, Transport Canada continues to conduct research in this area, much of it under the auspices of ISO TC22 SC13 WG8.

In previous projects, we have examined the Occlusion and Lane Change methods. In fall 2011, Transport Canada will contribute to a multi-site study examining the utility of the Detection-Response Task as a tool for the assessment of driver distraction. This

new work item for ISO is of particular interest as it shows promise for assessing distraction arising from both visual manual and speech-based interfaces.

Automated Control in Motor Vehicles

Advanced Driver Assistance Systems (ADAS) apply sophisticated in-vehicle sensor, information and communications technologies to support the driver. These innovative systems are taking over tasks that were traditionally performed by the driver. The automation of basic control functions (e.g., automatic transmission, anti-lock brakes and electronic stability control) has proven very effective, but the safety implications of more advanced systems in the field are uncertain (e.g., lane keeping assistance). This project is reviewing the legal liability considerations in Canada associated with automated control in passenger vehicles from the perspectives of the driver, manufacturer, insurer and regulator.

Although the International Harmonized Research Activities Steering Group was dissolved, the need for harmonized research on vehicle safety has increased. The last active working group (IHRA-ITS) is providing scientific support to the UNECE WP.29 ITS informal group to help develop a set of safety principles for automated control in vehicles. This IHRA-ITS group is supported by Canada, Germany, France, Japan, Sweden and the United Kingdom.

Automation can provide users with safe, comfortable, convenient and efficient mobility. However, drivers need to be aware of the road traffic situation around their vehicle at any given moment. They should also be able to anticipate relevant changes in the road traffic situation. The document produced by the IHRA-ITS working group describes some of the human factors issues associated with driving task automation. It sets out some basic principles that will help to optimize system performance and avoid drivers being out-of-the-loop and unprepared to manage safety-critical situations when they arise. In driving situations where the advanced driver assistance systems control or support elements of the driving task, drivers should be fully aware of the performance and limitations of those functions.

Human Factors Issues for In-Vehicle Warnings

Advanced crash warning technologies are being implemented in vehicles. These technologies are intended to warn drivers of the need for corrective action and have the potential to improve safety by preventing crashes or mitigating their impacts. To be effective, however, the warnings provided by these systems need to lead the driver to timely and appropriate responses.

Transport Canada is investigating and developing methods to assess the performance of safety critical in-vehicle warning signals. NHTSA, SAE and ISO TC22 SC13 WG are actively working in this area as well. A number of dimensions are important to consider when evaluating the warnings drivers receive. These include driver acceptance, perception, and interpretation of the alerts as well as driver performance in terms of reaction time, response type, and appropriateness of response. Recent work in our lab has indicated that drivers may not know the meaning of warnings they receive or the various symbols even after training. An additional concern is the lack of consistency for a given warning type particularly across makes of vehicles. There may be a need for standardization to reduce the confusion that may arise from this situation.

Although in-vehicle warnings promise considerable benefit, drivers must understand them to respond appropriately. The goal of this work is to have a toolbox of performance measures (and criteria) that can be applied to automotive warning systems to evaluate their effectiveness. In addition, results of this work will provide input to human factors recommendations, guidelines and support for standards dealing with in-vehicle warnings.

Behavioral Adaptation to Backing aids

Increased interest in back-over crashes has prompted the evaluation of available technologies that might help to prevent these collisions. If the effects of these technologies on driver behaviour are not well understood, initiatives in the area may result in unanticipated changes.

A field study was conducted with 43 parent-aged participants driving their own vehicles for a period of two months. Their vehicles were equipped with one of three types of aftermarket reversing aid: two of the aids were video-based (one rear-view mirror display screen and one dash-mounted display screen) and the third aid was an auditory-based sonar system. Reversing performance was observed pre- and post-installation both with and without the use of the backing aid. Participants reported that the devices were useful at times, but also expressed dissatisfaction with all three aftermarket systems. There were a number of limitations with the three systems tested. They aftermarket video backing aids were often too slow to activate when the vehicle was put into reverse, the display screens were too small and hard to read because of poor image quality and glare under certain lighting conditions. The ultra sonic backing aid had too many annoying false alarms that caused drivers to mistrust the device.

At the conclusion of testing, an 'unexpected obstacle' was placed behind participants' vehicles without their knowledge and they were asked to reverse with the aid activated. Regardless of reversing aid type, the majority of drivers still collided with the unexpected obstacle. Although the systems investigated in this study may perform adequately enough to improve parking, they did not perform well enough to be considered a safety device. Future research is needed to evaluate the safety performance and used of original equipment backing aids.

Naturalistic Driving Studies: SHRP2 and the Canadian Naturalistic Driving Study

Naturalistic driving studies provide unique opportunities to obtain objective data for real-life crashes, near-crashes and normal driving. Previous experience in Europe, the US (100-car study) and Japan has shown that such large scale studies are an excellent way to collect otherwise unattainable data that can be used to enhance our understanding of drivers, their behavior and their use of new technologies in their vehicles.

There is a strong environment of cooperation between US and Canadian researchers as well as researchers from other parts of the world. Coordination in research activities and sharing of information and data are desirable outcomes of these projects.

Transport Canada personnel have been active participants in SHRP2 since the early days of the project and have been directly involved in the development of the RFPs and research planning and evaluation of this project. Transport Canada has membership on the SHRP2 Technical Coordinating Committee, a number of Expert Task Groups and chairs the SHRP2 Data Access Committee.

A Canadian Naturalistic Driving Study, modeled after SHRP2, will be conducted over the next few years. The results of this project will provide essential Canadian data to address road safety concerns.

REGULATORY INITIATIVES

Electronic Stability Control Systems

The Motor Vehicle Safety Regulations were amended on December 23, 2009 to introduce a new Canada Motor Vehicle Safety Standard (CMVSS) 126 Electronic Stability Control Systems, which requires that an electronic stability control system (ESC) be installed on all light-duty vehicles manufactured for Canada on or after September 1, 2011.

Light-duty vehicles include passenger cars, multi-purpose passenger vehicles, trucks and buses with a gross vehicle weight rating less than 4 536 kg. ESC technology assists the driver in maintaining control of a vehicle during emergency manoeuvres, such as swerving suddenly to avoid an obstacle or when cornering on slippery surfaces. Multiple international studies have shown that ESC has the potential of significantly reducing fatal crashes involving loss of control of light-duty vehicles. Analyses of Canadian crash data indicate that ESC could prevent approximately 29% of these types of crashes.

CMVSS 126 harmonizes the Canadian requirements governing ESC with those of the United States. Canada has also participated in the development of a global technical regulation for ESC under the auspices of the United Nations World Forum for Harmonization of Vehicle Regulations, which was adopted in June 2008. This ensures the Canadian requirements for ESC will be globally aligned, further facilitating international trade.

Restraint Systems and Booster Seat Safety Regulations

Transport Canada continues to be active in its efforts to improve the benefits to young passengers offered by child restraint systems. On May 12, 2010, the Department published updated requirements for the *Motor Vehicle Restraint Systems and Booster Seat Safety Regulations*. In addition to introducing a new dynamic test performed with a lap/shoulder seat belt assembly, these regulations better align many of the testing requirements with those of the United States, while maintaining several testing requirements that were unique to Canada. These new regulations are expected to continue to improve on the excellent record of child protection offered by Canadian certified infant and child restraints and booster seats.

Transport Canada officials will continue to be active at an international level, by working closely with the National Highway Traffic Safety Administration on developing new seat requirements and by participating in the International Organization for Standardization Working Group on child restraint systems. These activities will involve monitoring the latest child restraint developments, which would include expected future requirements for side impact simulations aimed at continuing to improve the safety offered by restraint systems.

Occupant Restraint Systems in Frontal Impact

In order to improve occupant safety and maintain regulatory alignment with the United States, Transport Canada is preparing a proposal that would update Canada Motor Vehicle Safety Standard 208 *Occupant Restraint Systems in Frontal Impact* by making reference to portions of the respective United States safety standard. Consistent with the United States Federal Motor Vehicle Safety Standard 208, it is expected that the amendment will propose to adopt lap/shoulder seat belts at the rear inboard position of vehicles with a gross vehicle weight rating under 4 536 kg. Proposed changes will also include modification to the 50th percentile male rigid barrier crash test by increasing the test speed from 48 km/h to 56 km/h, adoption of the United States standard's neck injury criteria and elimination of the head acceleration requirement. Further, the proposed Canadian amendment would adopt the 5th percentile female rigid barrier and offset deformable barrier requirements and test procedures from the United States standard as well as the out-of-position driver and passenger requirements and test procedures.

While most of the anticipated changes to Canadian safety standard 208 would align with similar requirements in the United States regulation, areas where the modified standard will remain unique to Canada include no requirement for unbelted barrier crash testing, no chest acceleration requirement and unique barrier chest deflection limits for all vehicles with a gross vehicle weight rating up to 3 856 kg.

Designated Seating Position

The definition of a designated seating position is currently being updated by removing the exemptions for temporary, folding or other auxiliary seats. This change ensures that seat belts are installed in all seating locations. The method for determining the number of designated seating positions is also being updated to promote seat designs that provide improved visual cues of where an occupant should sit in a vehicle. This ensures that occupants sit only in locations where they receive the safety benefits that seat belts and other safety features provide.

Vehicle Identification Number

Every vehicle manufactured or imported for sale in Canada is identified with a unique alphanumeric 17-character vehicle identification number (VIN). The code configuration provides information regarding manufacturer, year of production, make and model, and several technical details. The VIN facilitates vehicle identification for safety research and vehicle recall campaigns. It is also used by provincial and territorial jurisdictions for registration purposes. Vehicle distributors, financial institutions, insurance companies and police departments use the VIN for warranty validation, insurance claim verification, recall campaigns and vehicle theft investigation.

The amended Canada Motor Vehicle Safety Standard 115 *Vehicle Identification Number* requires that the VIN of any two vehicles manufactured within a sixty-year period and having a model year of 1980 or later must not be identical. Moreover, this amendment, published on February 5, 2009, offers more flexibility to manufacturers to encode mandatory information, aligns the Canadian requirements regarding the VIN system with those in the United States and helps ensure the free movement of vehicles between Canada and the United States.

Low-Speed Vehicles

An amendment to Canada Motor Vehicle Safety Standard 500 *Low-speed Vehicles*, published on July 28, 2008, updates many of the requirements for that prescribed class. It clarifies the original reason for establishing the class - to allow the use of such vehicles for short trips such as shopping, social and recreational purposes, in limited, planned and controlled environments. In particular, the amendment expands the class to include small trucks, while limiting all vehicles to a maximum gross vehicle weight rating of 1361 kg.

Furthermore, a minor revision to the definition of low-speed vehicle was introduced in support of zero emission vehicles, specifying that low-speed vehicles do not use fuel as an on-board source of energy. This is in keeping with the original intent that low-speed vehicles are environmentally friendly electric vehicles.

Hydrogen Storage on Vehicles

Transport Canada fully supports the concept of developing global technical regulations, under the 1998 Global Agreement of the United Nations Economic Commission for Europe. The department is currently working to develop a global technical regulation for safe hydrogen storage on vehicles. Canada has fully supported this regulatory development and has worked with the United Nations group providing research into reasons for past cylinder failures. The Department has also supported research work involving efforts to prevent cylinders from failing during fires. This work is being used to develop the requirement for the bonfire tests of hydrogen cylinders.

Roof Intrusion Protection

To reduce the number of severe injuries and deaths caused by rollovers, Transport Canada regulates the strength of vehicle roofs by way of Canada Motor Vehicle Safety Standards 216 *Roof Intrusion Protection* and 220 *Rollover Protection*. Standard 216 was implemented in September 1973. While it has been amended on several occasions in the interim period, the performance criteria for roof resistance above the front seats of motor vehicles has remained substantially the same. Standard 220 was implemented in September 1979 and deals specifically with the rollover protection of school buses. The performance requirements therein have not changed since its original publication.

The government of Canada most recently amended the Canadian safety standards relating to vehicle roof crush (i.e. standards 216 and 220) on November 11, 2009, to improve the safety of vehicle occupants in the event of a vehicle rollover by increasing the force applied to the roof structure during testing and extending the application of standard 216 to larger passenger vehicles. These changes maintain harmonization with safety standards recently amended by the United States government.

Global Technical Regulation on Motorcycle Brake Systems

Motorcycle brake system regulations have not kept pace with the advancement of modern technologies. With improvements to disc brake systems and the recent introduction of new technologies such as anti-lock brake systems and combined brake systems, modern motorcycles can be equipped with very sophisticated and effective braking systems.

In an effort to improve and update existing national standards, Transport Canada agreed to sponsor the development of a global technical regulation on motorcycle brake systems. The final document was adopted at the World Forum for Harmonization of Vehicle Regulations (WP.29) of the United Nations Economic Commission for Europe, held the week of November 14, 2006.

The global technical regulation No.3 on motorcycle brake systems was subsequently registered in the United Nations Registry of Global Technical Regulations, obligating contracting parties to begin the process to adopt the regulation as part of their national requirements. This regulation provides manufacturers the option to test their products to just one series of harmonized requirements, in order to sell to all contracting parties to the 1998 Global Agreement.

The global technical regulation on motorcycle brake systems is based on best practices within existing contracting parties' national regulations, while taking into consideration modern brake system technologies that could improve rider safety. In an effort to include the most stringent performance requirements, the regulation draws mainly from three existing national motorcycle brake system regulations, including the UNECE Regulation No. 78, the United States FMVSS 122 and the Japanese Safety Standard JSS 12-61.

Compared to the existing Canadian safety standard on motorcycle brake systems, the global technical regulation includes a more realistic test for braking in wet weather conditions, slightly more stringent requirements when subject to repeated brake applications and when braking from high speeds, and new requirements for motorcycles equipped with anti-lock brake systems.

Currently, the motorcycle brake system requirements in Canada are harmonized with the United States. Transport Canada subsequently proposed to include the requirements of the global technical regulation on motorcycle brake systems as an alternative to the existing national requirement, which would provide motorcycle manufacturers the choice of two globally recognized compliance options within the Canadian safety standard.

EUROPEAN ENHANCED VEHICLE-SAFETY COMMITTEE

Status Report for the 22nd ESV Conference

Dr. Dominique Cesari, Chairman

INTRODUCTION

The EEVC, European Enhanced Vehicle-Safety Committee, was formed in June 1974 and has been active in participating in the ESV-programme. We are pleased to present the EEVC Status report containing a summary of the most recent results of our work at the 22nd ESV Conference.

Advanced Anthropometric Crash Dummies

This working group is the longest active Working Group within EEVC. The scope of the Working Group includes adult as well as child crash dummies and corresponding injury criteria. An overview of recent activities of EEVC WG12 is given below:

WorldSID dummies. In March 2009 a status report concerning the 50th percentile adult male WorldSID dummy was completed [1] and in April 2010 a status report concerning the 5th percentile female WorldSID dummy [2]. The development of the 5th percentile female WorldSID dummy has been carried out within the European R&D project APROSYS. An extensive international evaluation of this female dummy is currently taking place and members of EEVC are participating in the Informal Working Group for Side Impact dummies that is considering the appropriateness of WorldSID for future regulations.

Figure 1: 5th percentile female WorldSID dummy

Advanced Frontal Impact Dummies. The main role on this work item of WG 12 is to advise on an advanced frontal dummy for regulatory use with appropriate injury risk functions. For this purpose WG 12 follows closely the international activities concerning the THOR dummy taking into account the recommendations formulated by EEVC in 2006 [3]. Specific to lower leg injuries, EEVC WG 12 published a study in March 2009 addressing the THOR-Lx Design and Performance [4].

Whiplash Dummies. After completion in 2008 of an extensive evaluation of various crash dummies for low-speed rear impact, from which it was concluded that the BIORID is the most suitable dummy for this type of accident, WG 12 has focused its activities on seat performance criteria (whiplash criteria). In Dec. 2010 an interim report on the analyses of real world (insurance) data was finalized [5]. The main finding of this preliminary study was that the neck injury criterion NIC and upper neck shear force seem to be the best predictors for short and long term neck complaints following a rear-end impact. The work on this topic will continue in 2011 using a larger insurance database and new seat tests with the BIORID dummy in order to verify and further elaborate on these initial findings.

Child Dummies. The focus of the EEVC work in this field is on the new generation of European child dummies: the Q dummies. From a study completed in 2008 [6] it was concluded that the Q dummies offer a major step forward compared to the current P dummies used in UNECE Regulation 44. Currently the following 5 dummies are available in the Q family: a new born, a 9 month, a 1.5 year, a 3 year and a 6 year old dummy. The development of a 10 year old version of the Q dummies is taking place in the European project EPOCH [7]. The dummy is expected to be completed in 2012. WG 12 monitors these developments and plans to deliver a status report after completion of this dummy in 2012.

References

1) Status of WorldSID 50th Percentile Male Side Impact Dummy, EEVC WG12 Report Doc547 March 2009, see www.eevc.org.

2) Status of WorldSID 5th Percentile Female Side Impact Dummy, EEVC WG12 Report Doc557 April 2010, see www.eevc.org.

3) EEVC Recommendations on the Future of the Harmonised THOR Dummy, Report on the outcome of the Special Workshop on "Harmonization of THOR – The Advanced Frontal Dummy", held 4-5 May 2006 at TRL, UK, see www.eevc.org.

4) Report on THOR-Lx Design and Performance, EEVC WG12 Report Doc. 546, March 2009, see www.eevc.org

5) Summary Report: Requirements and Assessment of Low-Speed Rear Impact Whiplash Dummies, EEVC WG12 Report , Doc. 505C, Oct. 2008, see www.eevc.org

6) Advanced Child Dummies and Injury Criteria for Frontal Impact, EEVC WG12 Report, Doc. 514, April 2008, see www.eevc.org

7) http://www.epochfp7.org

Side Impact Protection

The car side impact problem in Europe remains substantial and a frequent cause of fatal and serious injury. For this reason, the EEVC's Working Group 13 has been active over recent years in providing advice concerning measures to reduce the risk of injury to road vehicle occupants in the event of a side impact and issued its latest report in March 2010. In this latest period, the working group focussed on determining the accident and casualty profile of European side impact accidents, and considered the development of a modified barrier based, pole and interior headform test procedures. The societal benefits and associated costs of a series of potential options for the modification of UNECE Regulation 95 were aalso considerd.

French, Swedish and UK national data were analysed and showed that around one quarter of car occupant casualties are injured as a result of a side impact. However, this rises to between 29% and 38% for those fatally injured, illustrating the more injurious nature of this type of collission. In side impacts 60% of casualties are 'struck side' (SS) occupants and 40% are 'non-struck side' (NSS). The proportion of fatal casualties in simple car to car or car to pole impacts is substantial, 50% and 67% for the United Kingdom and France, emphasising both the relevance and importance of the mobile deformable and pole impact tests.

An analysis to estimate the likely societal benefits for modifications to UNECE Regulation 95 was completed for Great Britain; this highlighted that there is still much benefit to be gained from the side impact safety measures in place today for Europe (i.e. UN-ECE Regulation 95 and Euro NCAP). However, the introduction of a regulatory pole test (to the current Euro NCAP specification with full dummy assessment) into the existing UN-ECE Regulation 95 would deliver significant benefits to society in terms of fatal and serious injuries.

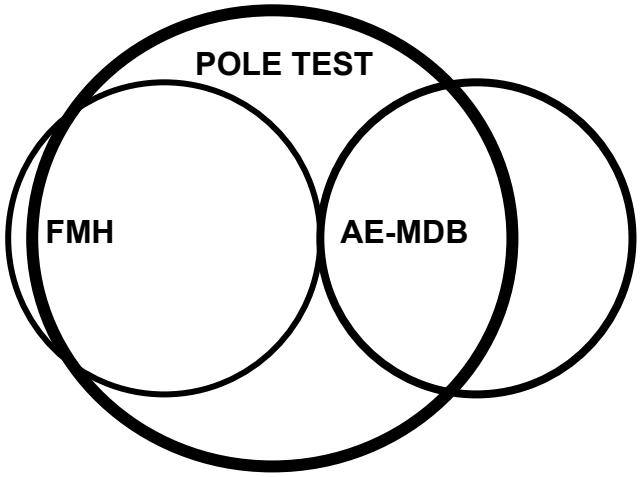


Figure 2: Interaction of different test procedures based upon potential benefits

Whilst the configuration of the current Regulation 95 barrier based test remains relevant, it is accepted that a more representative barrier is desirable and supportable from a safety perspective. Key characteristics of a revised test have been defined, though further work is needed to finalise the specification of the AE-MDB barrier Version 3 before it can be considered for use.

The EEVC WG13 test procedure for interior headform has been assessed as not fit for regulatory application at this time. Whilst a new test procedure has been identified and could be developed for use, the benefits from introduction of an interior head impact test appear limited at this time.

An analysis of National and in-depth data has been identified as the requisite first step towards better understanding of the injuries to non-struck side occupants, their associated mechanisms and determining the effectiveness of potential countermeasures.

EEVC current activities

EEVC has several active working groups dealing with the following topics:
-Car to Car compatibility
The working group on compatibility runs activities linked to the FIMCAR European research project. This group will analyse the results of FIMCAR as soon as they are available, with the aim to review these results with a pre-regulatory view.
-Child safety
In addition to the work reported above EEVC has focused its activities on child safety in the area of children transported in coaches and buses. In order to evaluate the importance and the specificities of this situation an accident an analysis has just been performed by the EEVC accident studies working group (WG21).
-Virtual testing
EEVC has developed a new mandate for the working group dealing with this topic. This group will use a methodology based on case studies, from the most simple case (limited to geometry assessment) to the most complex (prediction of complex internal injuries).
-Bus and coach safety in frontal impact
EEVC recently began an investigation on this topic. The first step consists of an accident analysis performed by EEVC experts in this field in order to evaluate the importance of the problem and the conditions of representative accidents.

Future of EEVC

EEVC, which has contributed to IHRA activities from the beginning; is convinced that pre-regulatory safety vehicle research has to be approached at world-wide level; within that objective the Steering Committee of EEVC has confirmed that non-EEVC countries can participate at WG level to share their research with ours.

An EEVC Work Plan for the coming years

EEVC has existed for more than 40 years, and during this period the environment of pre-regulatory research in the field of vehicle safety in Europe (and world-wide) has considerably evolved. EEVC's Steering Committee has decided to launch an internal reflection on its future, with the challenge to understand better the new world in which we have to work and to determine our future research directions and priorities.

The discussion will consider the links with WP29, in order to take into account the agenda of WP29/GRSP (and other GRs dealing with vehicle safety) in EEVC priorities and to find the most efficient manner to report EEVC work to these bodies.

The links with the European Commission will also be addressed in the discussions, especially the relations with DG Entreprise (in charge of regulatory aspects) and DG Research.

The planned discussions will also review the questions related to the status of EEVC, the procedures for financing researches prioritised by EEVC as well as the involvement of new countries in EEVC activities.

EEVC's Steering Committee has decided that the setting of the research agenda is the critical parameter in the further work of the EEVC, for both the scope of its activities and its priorities. It was agreed that short term and longer term research needed to be considered together.
For that purpose the EEVC Steering Committee has planned to meet in May, and expects to be able to report on our priorities during the oral presentation of EEVC Status Report at the 22nd ESV conference

In conclusion we are proud to note that EEVC has participated in all ESV conferences and has been responsible for organising the European part of the Student Safety Technology Design Competition since its inception. This year this was possible thanks to the FIA Foundation who sponsored the event, and some EEVC Steering Committee who contributed to the organisation of the competition.

STATUS REPORT, FEDERAL REPUBLIC OF GERMANY

President and Professor
Dr.-Ing. Peter Reichelt
Federal Highway Research Institute
Germany

22th ESV-Conference

Washington DC, 13th to 16st June 2011

1 Status and Trends

1.1 Road accidents in Germany

The number of road accidents decreased for the last 10 years until 2009 – by nearly 2% to 2,313,453 road accidents in 2009. Although there were light increases in single years such as 2004 or 2007, on the long run, accident figures have still decreased. However, the forecast for 2010 once again indicates a further increase in accident figures (2010: 2.34 million road accidents).

The number of road accidents with personal injury has decreased by more than 18% since 2000, resulting in 310,806 road accidents with personal injury in 2009. For 2010 a further decrease of almost 7% to approximately 290,000 injury accidents is expected.

Casualty figures have also decreased, with lower reductions for slight injuries and higher reductions for severe injuries and fatalities. The total number of casualties has decreased by more than 21% from 511,577 in 2000 to 401,823 in 2009. For 2010 a reduction of approximately 5% compared to 2009 has been predicted – to about 380,000 casualties in 2010.

Since 2000, the number of severe injuries has been reduced by 33% to 68,567 seriously injured road users in 2009 and the number of slight injuries has been reduced by 18% to 329,104 slightly injured road users. Fatalities have decreased by 45% from 7,503 fatalities in 2000 to 4,152 fatalities in 2009 – which is the lowest number of fatalities ever recorded by the national road accident statistics. And this positive development will go on. A reduction to approximately 3,750 fatalities has been predicted for 2010.

1.2 Socio-economic costs due to road traffic accidents in Germany

The Federal Highway Research Institute (BASt) calculates the costs of road accidents on an annual basis. The cost of road traffic accidents to Germany's national economy includes personal injuries and damage to goods.

Due to changes in central parameters of the German accident cost calculation, the costs of personal injuries and damage to goods were redetermined by a research project, in which new calculation models have been developed for all cost components to gain knowledge about the economic losses caused by traffic accidents.

The calculated costs include direct costs (e.g. for medical treatment, vehicle repair/replacement), indirect costs (for police services, the legal system, insurance administration, replacement of employees), lost potential growth (including the shadow economy), lost value added of housework and voluntary work, humanitarian costs, costs of monetised travel time losses due to accidents on motorways. Using the developed calculation model an analysis of very severe injuries and the effect of underreporting on total accident costs could be accomplished.

The calculated total accident costs for 2009 amounted to approximately 30.52 billion Euros.

Furthermore, personal injuries amounted to 13.29 billion Euros. Costs of about 17.23 billion Euros were caused by damage to goods.

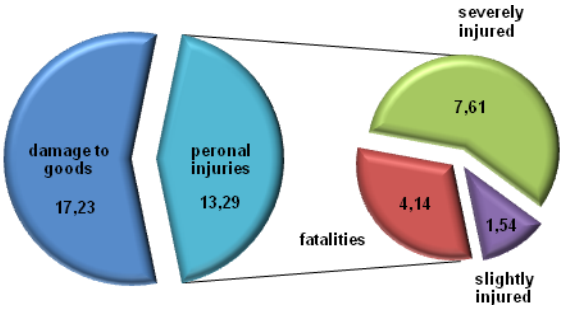


Figure 1: Costs due to road traffic accidents (billion Euros)

1.3 Vehicle population and road performance

Germany, with its 82.3 million inhabitants, is the most populated country in Europe and plays an important role for transit traffic. The number of passenger cars in Germany on 01/01/2008 was 41.2 million. Caused by a change in registration method (without temporary stopped cars), a comparison to the year before is not possible. Traffic intensities on the approximate 12,700 km of federal motorways in 2009 were about 48,800 vehicles per 24 hours on average (ADT).

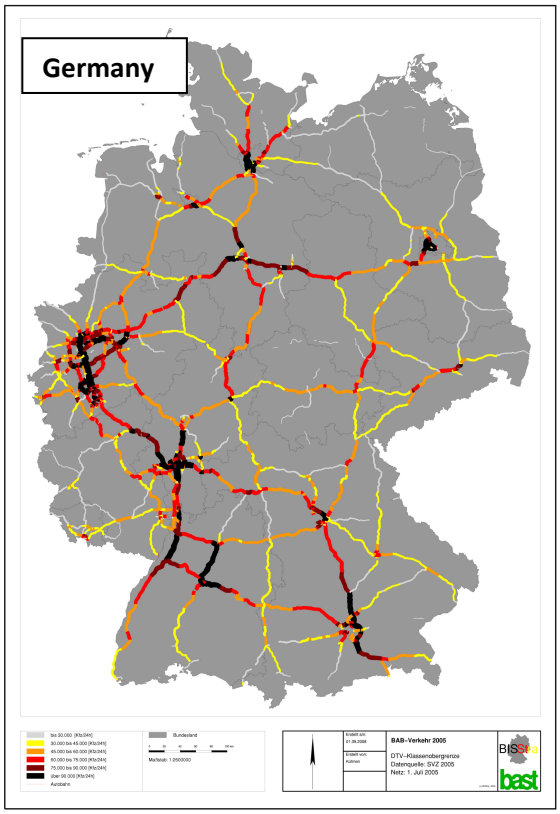


Figure 2: ADT of all vehicles on federal motorways in 2005

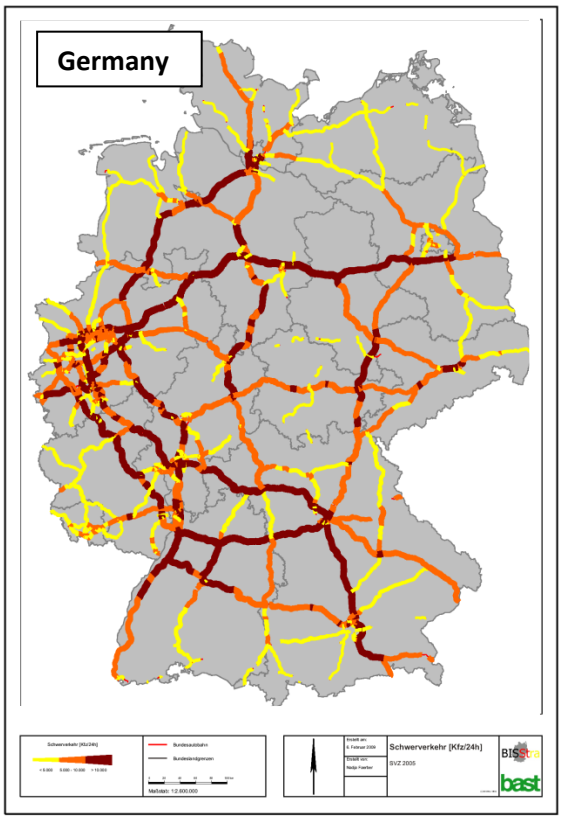


Figure 3: ADT of trucks > 3.5 t on federal motorways in 2005

The ADT of vehicles with a permissible total weight of above 3.5 t was on federal motorways in 2009 about 6,780 heavy vehicles. Figure 2 and 3 show the situation in the year 2005.

The total driving performance of all vehicles in 2009 was preliminary about 699 billion vehicle-km, out of which over 30% took place on the federal motorways alone.

1.4 Automotive IT

Information and communication technologies (ICT) are becoming more and more prevalent in modern life. In the world of transport and traffic, these systems are of greater importance than in earlier times. These systems lead to an upgrade in comfort, environmental protection and road safety.

Moreover, even portable devices are finding their way into cars. This finding is underlined by the fact that today more portable navigation systems are sold than systems provided by original equipment manufacturers.

Figure 4: Portable system

Smart phones (e.g. iPhones) are offering a constantly growing number of applications in the field of transport and traffic, e.g. navigation services. Some advantages of these systems are – apart from their lower price – that they are not permanently installed, thus easily replaceable, easily upgradeable and updateable, have a greater functionality and can be also used outside the vehicle. Apart from all of these advantages for the user, however, other challenges exist which should be taken in account:

In order to deploy the benefits of portable devices it has to be ensured that they can be safely used by the driver while the vehicle is in motion. In particular portable or nomadic devices are often not specifically

designed to be used while driving. For this reason the safe and efficient design of the in-vehicle Human-Machine-Interface becomes a key issue. Safe and efficient design is, for example, related to the safe fixing of the devices in the vehicle interior, the ergonomic design of display and control elements but also driver-system-dialogues and consumer information. These issues constitute major challenges for future research, development and regulation.

Another aspect which should be kept in mind is that ICT systems bring along new risks of misuse, manipulation and third-party-attacks. Consequently it is necessary to protect electronic systems. This mechanism is called "eSecurity" – taken from the terms "electronic" and "secure".

Future Cooperative Systems, such as Car-to-Car and Car-to-Infrastructure communication technologies will require an unprecedented security concept, too. In future this will be a major field of action.

1.5 Electromobility

The German government decided to implement a strategy to achieve a significant breakthrough of electric vehicles on German roads back in summer 2009. This "National Development Plan" has the ambitious goal to have at least 1.000.000 electric vehicles on German roads by 2020. Key elements of the strategy are the funding of research and development in Germany in those fields of technology that still need to progress (e. g. electric vehicles propulsion batteries), but also "model scale" experiments to understand the use of electric vehicles and help to define specifications for future electric vehicles. The strategy demands a coordinated approach that involves all relevant players in Germany – industry, academia as well as the government. This coordination is done via the "National Platform on Electric Mobility", set up in May 2010 by Chancellor Angela Merkel herself. The platform discusses approaches, develops road maps and also proposes topics for further funding by the government.

The "National Platform" is organized by the Federal Ministry of Transport, Building and Urban Affairs (BMVBS) and Economics (BMWi) by a joint office ("Common office on electric mobility"). It is formed by seven working groups, addressing the topics Propulsion Technology (Group 1), Battery Technology (Group 2), Charging Infrastructure and Grid Integration (Group 3), Normative Standards and Certification (Group 4), this group also addresses vehicle safety regulations, materials and recycling (Group 5), Education and Qualification (Group 6), Socio-economic Constraints (Group 7). Each working group involves high-level members from industry (including several CTOs and CEOs from OEMs and suppliers), academia and government.

The "National Platform" published a first mid-term report in November 2010 that further refines the strategy for the "National Development Plan" and defines road maps. It will also be the National Platform's responsibility to monitor the road maps' implementation.

2 Research

2.1 Safety of electric vehicles

Electric vehicles do offer advantages over conventional vehicles. They can help to cut local pollutant and greenhouse gas emissions, and they can lower Germany's dependence on crude oil. This being said, these vehicles also incorporate new technologies that could pose new risks on traffic safety. These aspects need to be adequately addressed parallel to the growing share of electric vehicles. Severe accidents in an early phase would very likely give electric vehicles an image of being unsafe - although this might not be the case and unjustified – and as a consequence the public demand would decrease, in the worst case the breakthrough of electric vehicles into the mass-market would not happen.

One of the issues that is being addressed by the UN ECE and other regulatory bodies and that is also a research topic all over the world is the quietness of electrically-propelled vehicles. This could be a risk for blind pedestrians, but also for other groups of vulnerable road users. On the other hand, even conventional passenger cars have become relatively quiet over the last decade – which was a common wish of all relevant stakeholders in order to cut environmental noise.

German national and regional research as well as European research projects aim at quantifying the risk of those silent vehicles and developing methods beyond sound. The UNECE will very likely propose a first step guideline for approaching vehicle audible systems. These systems are already recommended in Japan and will probably become mandatory in the US as well.

Electric vehicles use relatively high voltages in their power-train and batteries. These voltages could be harmful to occupants (and to a lesser extend or in case of an accident to external persons) if there is no adequate protection. Again, the regulatory bodies develop amendments to today's safety requirements. For in-use safety and protection against electric shock the corresponding regulation is already updated. For crash and post crash safety the work is in progress. However, various research questions with regard to driving dynamics, compatibility, safe rescue and maintenance still need to be answered.

Specific research questions are for example: how do battery systems behave in the case of an accident, will

there still be a risk coming from the batteries in the phase of towing after the accident, how could first aiders and rescue workers be efficiently protected from electric and chemical hazards.

The current amendments to regulations for in-use safety and post-crash safety of electric vehicles will be reviewed after research projects have answered these questions.

For now, at least from today's perspective the first steps have been made for a safe introduction of electric vehicles. And of course the test organizations (like Euro NCAP) and crash test facilities prepare to test electric vehicles with at least the same requirements that today's vehicles have to fulfill and by taking into account the specific properties of the propulsion system.

2.2 Forward looking safety systems

The positive development in road traffic safety which we could observe in the past decades, is based to a great extent on measures of vehicle safety, especially on those of passive safety. Seat belts, stiff passenger compartments, improved vehicle structures and airbags are the basis of good occupant protection. During the last years further systems were implemented like active or adaptive restraint systems as seat belt pre-tensioners and load limiters. At present it becomes obvious that also forward looking and integrated systems of vehicle safety respectively will play an increasing role in reducing the number of accidents and casualties.

While in the area of vehicle crashworthiness test procedures have been established and refined for years, the technology of accident avoidance is at the beginning of its development. E. g. from the application of forward looking emergency braking systems to passenger cars a high benefit for road traffic safety is expected. Approx. 35 % of the killed vehicle occupants can be assigned to longitudinal traffic accidents. The systems which are under discussion in principle work using three stages. First, in case of an imminent accident the driver should be warned and herewith requested to act in a way such that he can master the situation himself. If he brakes too weakly, the system should automatically increase the braking force just as much as necessary for avoiding the collision. If the driver does not react at all, the system should automatically and maximally brake just before an inevitable impact and thus significantly reduce the impact energy.

Up to now objective and generally recognised test procedures for the described systems do not exist. However, research activities on this item have been initiated and established world-wide between vehicle manufacturers, suppliers and research institutions.
Here at the first place, the US the project "Crash Avoidance Metrics Partnership" (CAMP) promoted by the US-American National Highway Traffic Safety Administration (NHTSA) is to be mentioned.

In Europe the research project ASSESS (Assessment of Integrated Vehicle Safety Systems for improved vehicle safety), which is funded in the 7th R&D framework programme by the European Commission aims at developing harmonised and standardised assessment procedures and related tools for frontal pre crash sensing systems. Procedures are developed for driver behaviour evaluation, pre crash system performance evaluation, crash performance evaluation and socio economic assessment. As result a relevant set of test and assessment methods applicable to a wide range of integrated vehicle safety systems is expected.

Figure 5: Test of the crashability of the ASSESS target with propulsion system carried out by BASt

It is planned to carry out a following project called AsPeCSS (Assessment methodologies for forward looking integrated pedestrian and further extension to cyclists safety systems), which focuses on forward looking safety systems that are designed to address pedestrian and cyclist accidents. It is the aim to deliver harmonised test procedures as input for further regulatory and consumer rating activities.

For the development of harmonised test procedures for integrated safety systems all German car manufacturers, the Federal Highway Research Institute (BASt) and the German Insurance Association have got together under chairmanship of DEKRA in the consortium "vehicle frontal safety systems" (vFSS). Based on real accident data test and assessment procedures for pedestrian protection systems and systems for the avoidance and mitigation of rear-end collisions are developed.

The above mentioned projects show that at a lot of national and world wide activities are around the specification of active and integrated safety systems. Now it is a matter of bundling these activities and of using the chance of an early world-wide exchange about the potential benefit of advanced forward looking and in case of an imminent crash braking safety systems, no matter if it is an accident between two cars or between a car and a vulnerable road user.

This includes an agreement of the definition of test procedures for these systems. Therefore, BASt and NHTSA have concluded on April 26th, 2010 in Washington D.C. a memorandum of cooperation. The aim of this cooperation is the exchange of research results and the execution of common analyses between CAMP and vFSS on the named subject.

2.3 Cooperative systems – integration of existing systems

In the past, substantial progress was made in the reduction of road accidents and journey times through the installation of road infrastructure. Various systems both in the fields of traffic safety and efficiency have been installed by the road operators, e.g. traffic control systems or variable message signs.

With the development of Cooperative Systems a new promising technical advancement is disposable. By combining advanced driver assistance systems (ADAS) and established road infrastructure telematics with mobile communication (e.g. WLAN, cellular) new potential is generated to improve the driver's provision with information regarding traffic safety and efficiency related affairs. This includes higher information density, faster information distribution and improved up-to-dateness.

But the potential rollout of cooperative systems raises various questions from the viewpoint of a road operator. Those concern especially the integration of existing systems as the established implementation of conventional systems was often subject to long term strategy which does not incorporate the complete replacement in short periods.

For this reason an approach is required that accounts for the possible integration of existing systems when deploying Cooperative systems. Since an architecture is supposed to provide the framework for the successful operation of Cooperative Systems it is an obvious choice to add the issues regarding the integration of established systems. With the different viewpoints of an architecture describing the various layers of a system a powerful tool is provided to pioneer the incorporation both technical and organizational.

The entire architecture topic will be addressed in the context of Mandate M/453 towards the European Standardisation Bodies published by the European Commission in 2010. The Federal Highway Research Institute both introduced this issue and will actively contribute to architecture standardization. CEN will consolidate the necessary activities.

2.4 Safety related traffic information

The "ITS Directive"[1] of the European Commission has defined Priority Actions for the development and use of specifications and standards in the upcoming years. One of these priorities is the definition of "data and procedures for the provision, where possible, of road safety related minimum universal traffic information free of charge to users".

Within the next years, the European Commission will define functional, technical, organizational and service provisions that describe the roles of the various stakeholders and the information flow between them in so-called specifications. A specification for Priority Action "Safety Related Traffic Information" is expected at the end of 2012 and shall include the following:

- *the identification and use of a standardized list of safety related traffic events ('universal traffic messages') which should be communicated to ITS users free of charge,*
- *the compatibility and the integration of 'universal traffic messages' into ITS services for real-time traffic and multimodal travel*

Since 2007, when Germany has held the Presidency of the EU Council, German experts are working on a proposal of the list of safety related traffic events. The challenge is to organize the provision of such an interoperable minimum service amongst all parties involved. There are technical questions to be solved but even more challenging are the business issues. To provide safety-related information free of charge to the end user doesn't mean that the generation of this information won't raise cost. This is especially an issue with commercial partners that fulfill a role in the value chain of providing this information, e.g. in the phase of detecting safety related events, or in the phase of sending safety related messages to the end user.

A group of German stakeholders – public and commercial representatives – has made a proposal on a first list of categories of safety related information:

- *Category: Information on ghost driver (driving on the wrong lane)*
- *Category: Information on dangerous road surface*
- *Category: Information on reduced visibility*
- *Category: Information on animals / people / debris on the road*
- *Category: Information on unmanaged road closure*

[1] Directive 2010/40/EU: "Proposal for a Directive of the European Parliament and of the Council laying down the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other transport modes"

- *Category: Information on unprotected accident area*
- *Category: Information on short term roadwork (minimal signage)*
- *Category: Information on unexpected end of queue (economic feasibility to be analysed)*

By analyzing the value chains – each step from event detection to message provision – for each of the categories all partners involved were identified. The challenging discussion on sustainable models of cooperation between all parties is still ongoing – also on an European level – and will give a major input on this issue to the legislative process of the European Commission with the framework of the ITS directive.

Implementation of eCall in Germany

The European Commission (EC) attaches great importance to the implementation of eCall, which has been identified as an efficient ITS service that can be deployed in the short term. eCall is a standardized automatic crash notification service for road safety based on the European emergency call number 112. The eCall initiative of the EC is supported by the German Federal Ministry of Transport, Building and Urban Development (BMVBS). Germany has signed the Memorandum of Understanding on eCall during the German Presidency of the EU-Council in 2007.

The member states of the EU are responsible for the implementation on a national level, i.e. to ensure that emergency calls under eCall can be received and followed up by national Public Service Answering Points or rescue coordination centres. In 2009 the German regulation on emergency calls has been updated in order to include eCall.

In 2009 the EC has initiated the European eCall Implementation Platform (EeIP) which aims to push the deployment of eCall on European level. A national German implementation platform has been launched by the German ministry of transport. The national implementation platform brings together all relevant stakeholders and coordinates the implementation activities of the federal states which are responsible for the implementation of eCall in the existing emergency services in Germany. Some of the federal states will be involved in the project HeERO, a pre-deployment pilot study funded by the EC. The pilot study will run from 2011 to 2013 and test the communication infrastructure needed for eCall in the PSAPs.

Currently, the EC is checking whether to deploy eCall on a voluntary basis or a mandatory basis. A decision of the EC is expected by mid of 2011. The further procedure of the eCall deployment in Germany depends on the decision of the EC.

2.5 Freight transport

2.5.1 Action plan freight transport and trial with longer trucks

In the context of the predicted increase in freight transport, the Ministry of Transport Building and Urban Affairs published in 2010 an action plan for freight transport and logistics. For road freight transport the aim is to increase the productivity and decrease the environmental impact. New technologies and an increased use of combined transport are main topics. One proposed measure is the introduction of longer but not heavier articulated trucks in a trial in Germany in 2011. The truck combination length may be increased up to 25.25 m (to load 3 instead of 2 swap bodies or containers) while the gross vehicle weight stays at 40 t or 44 t in combined transport respectively. These trucks should be equipped with the latest generation of driver assistance systems and should fulfill the standard turning circle requirements to avoid any conflict with the road infrastructure. Only specially trained drivers will be allowed to drive these larger trucks and a "street map" where these longer trucks may be operated will be made available by the Federal States. BASt is assigned to conduct in the technical and scientific monitoring of this project.

Figure 6: Truck of 25.25 m length

2.5.2 Lane Departure Warning Systems and Advanced Emergency Braking Systems (AEBS) for heavy duty vehicles

With the regulation (EC) No. 661/2009 of the European Parliament and of the Council concerning type-approval requirements for the general safety of motor vehicles AEBS will become mandatory for heavy duty vehicles and busses. It is expected that the systems contribute to reduce accident figures and accident severity with regard to rear end collisions and departure accidents. These accidents often show a high severity due to the high masses of the vehicles involved. Beginning 1st November of 2013 new types of vehicles and beginning 1st November of 2015 all new vehicles must be equipped. Performance criteria which have to be fulfilled by the systems, however do not exist yet. They are elaborated by an informal group of experts on UNECE-level. Here it is taken into account that the requirements on the one hand could be

fulfilled with existing technology and reasonable costs but on the other hand are thus demanding that traffic safety will of course benefit from the fitment of the systems.

2.6 „BioRID TEG, dummy harmonization“

For several years, work is in progress with regard to develop an improved regulatory dynamic test procedure for head restraints with the aim of mitigation of neck injuries. The dynamic test option in the current GTR No. 7 on head restraints foresees the use of a Hybrid III dummy using the test pulse as described in FMVSS 202a. According to several studies like those from EEVC, the Hybrid III is lacking biofidelity under rear impact conditions and is not humanlike enough for seat or head restraint testing. In consumer test programs like Euro NCAP or IIHS, the BioRID is used for many years for the dynamic assessment of seat performance under rear impact conditions. However, several concerns have been raised about the repeatability and reproducibility of the BioRID. As the anthropometric test device (ATD) is the crucial factor in a dynamic test a suitable dummy needs to be defined for use in regulation. Several studies have shown that out of the available dummies (Hybrid III, THOR, RID3D, BioRID) the BioRID seems to be the potentially best suitable dummy for low speed rear impact seat testing.

Within the framework of the Informal Working Group on a GTR No. 7 on head restraints phase 2 a BioRID Technical Evaluation Group (TEG) has been given the task to improve the BioRID and to develop the necessary specifications and documentation for regulatory purposes. The BioRID TEG started its work in January 2010 and most of the meetings are hold as WebEx meetings with some joint face to face meetings with the GTR No. 7 group. The BioRID TEG is chaired by BASt. The TEG has made significant progress and quite a lot of issues have been discussed, investigated further and addressed in the meantime e.g. by technical bulletins released by the dummy manufacturer (now Humanetics after the merging of Denton and FTSS). A drawing package is now available on the UNECE website as well as a new draft certification procedure; a built level check list has been published as well as a PADI (Procedures for Assembly, Disassembly and Inspection). Work is ongoing with the aim of reducing the response corridors during certification and refining the certification procedure. The improvements developed and proposed by the TEG and the new certification procedure are used by Euro NCAP and IIHS, too. The aim is a worldwide harmonized BioRID for testing under rear impact conditions for regulatory purposes as well as consumer testing. A really challenging task of the GTR No. 7 group and the BioRID TEG will be the development of validated injury or seat performance criteria addressing the risk of cervical spine distorsions.

A similar work is done by the UNECE Informal Group on Side Impact Dummy Harmonization. The aim of this group is to introduce the WorldSID 5% and 50% percentile as a worldwide harmonized side impact dummy into regulation (and as far as possible into consumer test programs, too). In contradiction to the BioRID, the WorldSID itself has only been used in research up to now and not for consumer testing before. On the other hand, different side impact dummies are used by the contracting parties of the 1998 agreement in their domestic regulations or standards (e.g. ES2, ES2RE, US-SID).

There are also activities around the world with regard to the improvement or further development of frontal impact test procedures under regulatory aspects as well as in consumer test programs. The currently used Hybrid III family which was basically developed in the 70th has several limitations. Having in mind the demographic impact and the findings by European projects like THORAX and COVER, an improved test tool seems to be needed e.g. for a better prediction of the thoracic injury risk. The THOR dummy has a good potential for worldwide harmonization on a frontal impact dummy. However, at this point only two prototypes with the latest upgrade kit are available. If changes in regulations or in consumer programs are planned in a short or midterm range the THOR seems to be some years away for this purpose. Therefore some organizations like BASt are working on other solutions that might be available earlier and which could serve as interim solutions until the THOR will be ready.

Technical solutions like RibEye or THUMPR are now available which can already be used in the Hybrid III. These systems can be mounted on each rib of the Hybrid III rib cage and are able to measure the deflection of the ribs in 2 or 3 dimensions. BASt is currently investigating whether and how these systems can be used for an improvement of injury risk assessment in the thoracic region.

Advanced dummy technology for assessment of thoracic injury risk

Analyses of recent accident data show that thoracic injuries are forming the largest portion of severe injuries in motor vehicle collisions. The evaluation of the injury risk to the thorax in frontal motor vehicle accidents is based in current test procedures on the chest deflection measurements in the dummy hybrid III. Several studies have shown the limited biofidelity of this dummy. Furthermore the chest deflection is only measured in one single point of the chest.

BASt is involved in various research activities to address this problem.

A multi-point chest deflection measurement device called RibEye available for the dummy hybrid III is

currently been investigated. With this measurement device it is possible to measure the chest deflection at multiple points of the chest. BASt is investigating if an improved assessment of vehicle safety can be achieved with this kind of advanced measurement system.

The RibEye is also available for the side impact WorldSID dummy (Figure 7), which might also have potential for improved assessment of thoracic injury risk in side impact. This will also be evaluated by BASt in future studies.

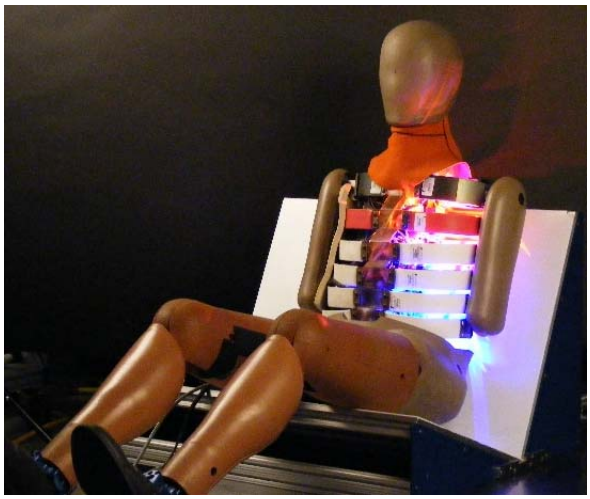


Figure 7: Advanced Chest Deflection Measurement System RibEye integrated in the Dummy WorldSID50%

BASt is also involved in the project THORAX (Thoracic injury assessment for improved vehicle safety) funded by the European commission. The aim of the project is to better understand the mechanism of thoracic injury in frontal impact. For this purpose accident data was analyzed to find the most relevant types of thoracic injury. The two injuries of highest importance were found to be rib fractures and lung injuries. Shoulder injuries and sternum fracture were identified to be of secondary importance.

The research findings of the project will be implemented in an updated design of a dummy thorax, which will be integrated in the advanced dummy for frontal impact assessment THOR (Figure 8).

Within the project injury risk curves taking into account user diversity will also be developed. Especially elderly and small female occupants, which have been found to be at high risk for thoracic injury in motor vehicle accident, will be considered.

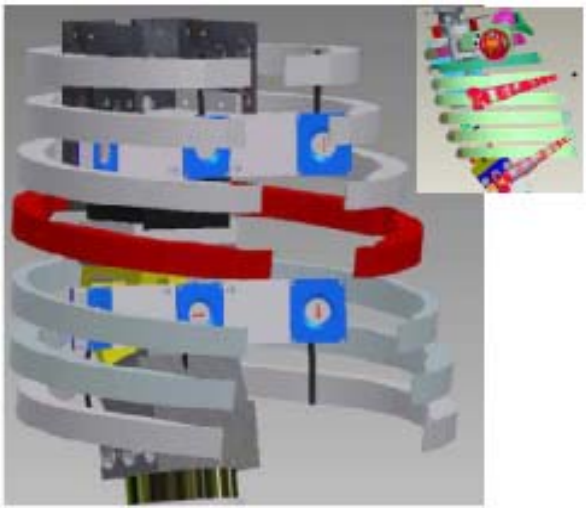


Figure 8: An improved dummy chest will be developed in the European research project THORAX and integrated in the THOR dummy

2.7 Compatibility

Vehicle safety has been improved in Europe with the introduction of legislative and consumer testing. Stronger occupant compartments and improved occupant restraint systems are evident in the higher assessments awarded in the Euro NCAP testing programme. However, in current passive safety tests the role of the collision partner is not considered explicitly.

Previous research supports the conclusion that vehicle-to-vehicle crash performance is worse than single vehicle-to-barrier test performance, even when the collision partner is an identical vehicle model. This unfortunate fact means that new safety features do not perform as well as expected in real world conditions. This behaviour is a function of the incompatibility encountered in the vehicle fleet today.

Based on the work in VC-Compat[2], 14-31% of fatally injured individuals and 29-52% of seriously injured individuals would be affected by improvements in vehicle compatibility – these are significant figures, particularly when being extended to the EU27. Some early estimates indicate that improved compatibility can reduce the annual cost of traffic injuries for society by € 2 billion per annum.

Although compatibility has been analysed worldwide for years, no final assessment approach was defined which motivates a need to further pursue compatibility research to improve the outcome of a significant proportion of EU road casualties.

France made in 2007 a proposal to amend ECE Regulation No. 94[3] and to introduce the PDB (Progressive Deformable Barrier) but the GRSP Informal Working Group of Frontal Impacts (IWG FI)

could not find an agreement between the parties. The IWG FI is still working and trying to set up a new proposal. Germany has made a proposal at the UNECE[6] on the steps forward and the requirements that shall be covered by the frontal impact regulation including the geometric alignment of vehicles' front structures. At this time the group is waiting for results from projects like FIMCAR and THORAX.

Figure 9: Car-to-car test

In the seventh framework programme the compatibility project, called FIMCAR (Frontal Impact and Compatibility Assessment Research), is establishing an assessment approach for frontal impact, integrating self and partner protection.

The FIMCAR consortium consists of 12 partners which include the important research organizations from Europe as well as seven different car manufactures. Japanese institutes are not an official partner; however an extensive collaboration is ongoing. Harmonization activities include also interaction with GRSP IWG FI and EEVC WG 15. Therefore it is expected that the proposal will be widely accepted.

The project includes six research and development work packages[4].

Work package 1 includes accident analyses and cost benefit analyses. Output is to identify and verify compatibility issues and to perform a methodology which predicts future fleet characteristics.

Work package 2 develops an off-set assessment procedure and is focusing on the PDB. The metric will assess the deformation as well as the homogeneity.

Work package 3 develops a full overlap test together with a metric using load cell wall measurement to address vertical alignment. Currently the FWRB (Full Width Rigid Barrier) and the FWDB (Full Width Deformable Barrier) are considered.

Work package 4 develops a moving deformable barrier assessment procedure. As barrier the PDB will be taken, test speed and trolley mass needs to be defined.

Work package 5 supports the other work packages by numerical simulation. Different kinds of simplified and generic models are developed to use for further studies.

Work package 6 combines the results of the other work packages to establish an assessment approach. Car to car testing as well as the development of a data base which includes previous crash tests is also part of WP 6.

Figure 10: Small family car in full-width deformable barrier test

Based on accident analyses performed different areas of compatibility issues were identified and rated.

Structural Interaction:
FIMCAR has high priority on establishing structural interaction assessments using both a full width and offset test to support alignment and load spreading.

Front End Force / Deformation:
Vehicles must have minimum energy absorption requirements which are likely to be resolved with the combination of a full width and an offset test. Force level issues were rated as lower priority and are unlikely to be resolved.

Compartment Integrity:
FIMCAR will maintain an offset test with sufficient test severity as current levels. Extended accident studies are ongoing to investigate if special actions for small vehicles are necessary. This was also rated as lower priority.

Restraint system
A full width test is proposed to assess restraint system capacity and to address acceleration injuries which were identified as important in accident analysis. A combination of tests is advised for sensor and restraint performance evaluation.

The current status is that a combination of a full width test and an off-set test will be proposed. The different test procedures are under development and needs to be finalized.

The **full width test** will be proposed in order to create a high deceleration pulse. It needs to be decided if the test will be with the full width barrier face or without. Metrics were developed based on the proposal from Japan[5]. With these metrics in particular the structural alignment will be addressed to provide a basis for further compatibility issues.

The **offset test** procedure will be proposed in order to test compartment integrity. The PDB barrier face was selected. With the proposed criteria the homogeneity as well as the deformation will be assessed based on barrier deformation plots. Existing ODB will be maintained if PDB cannot meet necessary performance requirements.

The **movable deformable barrier** (MDB) will be developed with a PDB barrier face. The MPDB test can address mass ratio compatibility issues which are probably not fully addressed in the fixed barrier tests. The MPDB is envisaged as a replacement for an offset barrier test.

Figure 11: A car in a movable deformable barrier test

Within the next months (until September 2012) further steps have to be performed to finalize the assessment procedure.

[2] Improvement of Vehicle Crash Compatibility through the Development of Crash Test Procedures (VC-COMPAT) - Final Report, GRD2/2001/50083, 15/02/2007

[3] Proposal for draft amendments to Regulation No. 94 - (Frontal collision) http://www.unece.org/trans/main/wp29/wp29wgs/wp29grsp/grsp2007.html

[4] Official website of the FIMCAR Project: http://www.fimcar.eu/project/

[5] Yonezawa, et al., ESV Conference 2009, Summary of Activities of the Compatibility Working Group in Japan

[6] Frontal Impact Regulation – Improving Occupant Protection http://www.unece.org/trans/doc/2010/wp29grsp/FI-07-06e.pdf

2.8 Child safety

2.8.1 Euro NCAP Child Restraint Systems (CRS)

BASt is chairing the Euro NCAP Child Safety Working Group. The group is dealing with a new child protection protocol with the aim to clearly improve consumer information. It shall motivate the CRS industry to develop well performing CRS for smaller children and the vehicle manufacturer to develop robust interfaces with more than one seat in mind. New aspects shall be included such as e.g. misuse. It will be a clear challenge to the vehicle manufacturer to work on the protection of larger children respectively small adults on rear seats. The new protocol should be based on the separation of the CRS assessment from car assessment for smaller children and use existing CRS consumer ratings to identify "best performing child seats", available on the European market. Within the dynamic Euro NCAP car tests, the young children should be replaced by older children. The Euro NCAP assessment should re-focus on CRS-car interface compatibility, vehicle based assessment and front/side impact dynamic results of older children. Within the scope of the group a protocol was drafted with regard to the interface and vehicle based assessment. The aim is to reflect the ability of a vehicle to transport children in CRS safely. A list of 9 seats, good/ best performing in consumer tests, has been identified for the use in the vehicle assessment. The chosen CRS cover all age groups and all installation methods.

2.8.2 CASPER

BASt is participating in the European project CASPER (Child Advanced Safety Project for European Roads). CASPER wants to develop a full understanding of the circumstances of the transport of children in vehicles and the requirements for the protection of children in the cars. The project takes into account passive and, if possible, active safety as well as sociological aspects. CASPER wants to develop test procedures (including virtual) for different accident-configurations. Proposals will be made for both, child restraint systems and their applications, as well as for devices in the vehicles with regard to their effectiveness for the safety of children in cars. A virtual environment for children (numerical models for child dummies and human models, child protection systems and vehicle restraint systems) will be developed. CASPER is supporting the work of the UNECE/GRSP Informal Group "Child Safety".

2.8.3 UNECE/GRSP Informal Group "Child Safety"

BASt is also involved in the work of the UNECE/GRSP Informal Group "Child Safety". The

Group deals with a new regulation for CRS. A step by step approach is implemented. The actual Phase 1 is dealing with ISOFix Integral "Universal" CRS. The new regulation shall include side impact testing, change the actual weight group system to an easier understandable solution, update the test bench, implement Q-Dummies in regulation and give the possibility to have universal rearward facing CRS with ISOFix anchorages. The aim is to enlarge scope of the group, after finalisation of Phase 1, in a second and third phase to other CRS types.

2.9 Research project IMVITER – virtual testing

The acronym 'IMVITER' stands for an EU project called "IMplementation of VIrtual TEsting in Safety Regulations". The main objective of this project is to work out recommendations for the implementation of virtual testing (VT) procedures in existing homologation procedures and the consolidation of advanced VT technologies for this purpose.

The EU project brings together 15 partners from 6 European countries: Automobile manufacturers, regulatory bodies and software developers as well as research institutions. Industry and regulatory bodies work together in order to build up a common vision and common understanding regarding VT in homologation/ regulation. The three-year cooperation started in 2009 and will continue through 2012.

This project is part of a long term process which might lead step by step to a complete "electronic certification", including full scale vehicles as well as human models instead of crash test dummies under certain safety directives. It is important to address today the technical feasibility, institutional acceptability and economic benefits and cost of enforcing these VT by working on simple cases. Technology development in this field will progressively provide industry and technical centers with more and more realistic and reliable models. This process is illustrated by Figure 12.

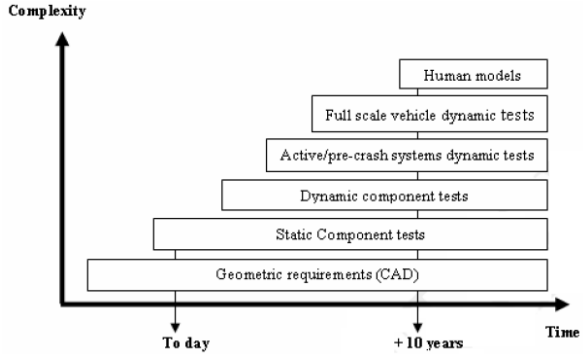


Figure 12: Stepwise progressive introduction of VT in regulation[7]

The achievement of this objective implies among others, that the accuracy and reliability of the simulation models and related procedures can be assured and rated independently. Thus, one of the obstacles of the use of VT in homologation/ regulation will be addressed: the lack of confidence in simulation tools for homologation/ regulation. The project will support to prove the reliability of these systems under certain safety directives.

The research project IMVITER consists of six technical work packages:

WP1: Identification of potential pilot cases
In WP1 detailed work plans of WP2 and WP3 were defined. Four pilot cases that will be further investigated in the project were selected related to three different safety directives/regulations:

- Towing devices acc. to Directive 77/389/EEC
- Safety-belt anchorages acc. to ECE Regulation 14
- Pedestrian lower leg protection acc. to Regulation (EC) Nº 78/2009
- Pedestrian head protection acc. to Regulation (EC) Nº 78/2009, see Figure 13

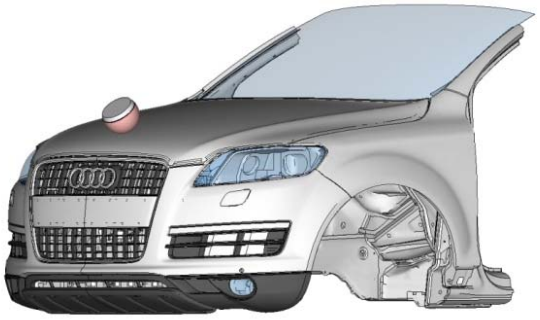


Figure 13: Audi Q7 FE-model[8]

WP2: Potential evaluation criteria of VT methods
The focus of this WP is on the definition of evaluation criteria of VT. The required accuracy of the simulation models and procedures must be ensured independently of the modeling process, software tools, computing platform and the performing organization. New correlation criteria will be proposed. Activities to improve predictability of numerical models according to the evaluation criteria requirements will be performed and guidelines for quality and reliability of simulation will be defined.

WP3: Proposals for VT homologation procedure
Based on the flowchart in Commission Regulation (EU) No. 371/2010 (see Figure 14) procedures to implement VT in the selected regulations will be defined in WP3. Hardware tests based regulations will be transferred to virtual test based or combined VT/RT regulations for each pilot case. Questions of liability and accountability are of major significance.

WP4: Implementation of VT on pilot cases
In WP4 the developed VT procedures for homologation/regulation will be applied in order to investigate feasibility and reliability of these procedures".

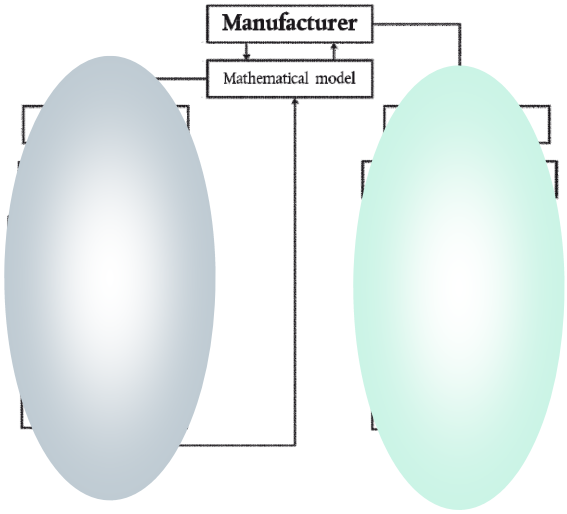


Figure 14: Flowchart in Commission Regulation (EU) No. 371/2010[9]

The process used for validations of homologation procedures by public authorities will be analysed. Recommendations will be drafted how VT procedures can be implemented in specific homologation/regulation procedures.

WP5: Cost-benefit analysis
A cost-benefit analysis and assessment will be performed in WP5.

WP6: Potential of VT in safety technologies
In this work package new biofidelic virtual test devices and active and pre-crash systems will be investigated. Currently these systems are tested via physical tests with activated mechanisms, but the activation mechanism and the sensing and actuation are not evaluated. The use of VT can allow evaluating these systems taking also into account a range of possible sensing techniques as well as the actuation mechanics and investigate their behaviour in real world scenarios. Requirements and obstacles to implement this kind of VT in current homologation/regulation procedures and proposals for future procedures will be analysed.

In general IMVITER is investigating the future potential of VT for homologation procedures by analysing how VT could result in cost reductions and increased competitiveness for European car manufacturers by substituting a range of real tests by VT.

[7] IMVITER, Description of work, 2009
[8] IMVITER, Deliverable D1.4, Detailed description and planning of WP2&3, 2010
[9] Commission Regulation (EU) No 371/2010, 16 April 2010

2.10 Druid – Driving under the influence of drugs, alcohol and medicines

The use of psychoactive substances such as alcohol, drugs and medicines is a major cause of many traffic accidents in Europe.

The European Commission decided to combat DUI (driving under influence) on the basis of solid research results, launching the integrated project DRUID (Driving under the influence of Drugs, Alcohol and medicines). In this project BASt took the part of coordinator, leading a consortium of 37 partner-institutes from 17 member states and Norway and administrating a total budget of more than 24 Mio €.

Figure 15: DRUID – Driving under the influence of drugs alcohol and medicines

DRUID aims at understanding the role of psychoactive substances as a main factor for traffic accidents. It was decided to conduct epidemiological surveys aiming to overview the actual situation with drug consumption in traffic in Europe; to implement experimental studies on how psychoactive substances impair fitness to drive; to analyze enforcement options; to collect and assess information on the impact of medicines and dispensing guidelines; to evaluate effectiveness of driver rehabilitation and licence withdrawal policies existing in the Member States.

The project is divided in seven Work-Packages (WPs) to cover the whole area of research. Working Groups for special issues were established, crossing WPs such as a toxicology group to establish a uniform and harmonized approach to sampling and analyzing or a conversion factors group, which tries to overcome the problem of using different sample substances (saliva, blood and plasma) in different studies and countries. All DRUID-participants collaborate very closely on a bilateral basis as well as within Work Packages. The range of disciplines within the project is widespread - physicians, pharmacologists, psychologists, toxicologists, methodologists, police officers. An important part of the collaboration is knowledge transfer. E.g. it has to be ensured, that all involved partners can work in compliance with unified standards for toxicological laboratories. In some countries, the appropriate equipment had to be installed and the staff had to be trained accordingly.

Some of the key aspects of the DRUID activities are:

Experimental and epidemiological studies

In order to analyze the impact of psychoactive substances on the ability to drive, DRUID employs different methodologies, well established and recognized by the international scientific community. All experimental studies conducted in DRUID have to follow a methodological framework, which assures the comparability of results.

Three main sources of information on the impairment caused by psychoactive substances are used within DRUID. These are epidemiological studies, experimental studies and meta-analyses. Each of these scientific approaches is linked to a specific measurement which reflects the amount of impairment. Epidemiological studies are conducted to obtain information on the prevalence of driving under influence of certain psychoactive substances. Epidemiological data compiled within DRUID contains samples collected from 50.000 drivers and 3.000 injured drivers. Accident rates are calculated for different psychoactive substances.

In experimental studies on several psychoactive substances a standardized driving test is conducted. For this test drivers have to drive on a highway while the lateral position of the car is continuously assessed. Here, amongst others, the amount of weaving is used as a measure for the amount of impairment caused by different substances.

Enforcement

Police bodies mainly use oral fluid screening devices for drug enforcement. Such devices have to meet the demands of the everyday police enforcement as well as to be reliable from a scientific/legal point of view. Within the project 13 oral fluid devices were evaluated by police teams; 8 devices have been qualified as promising. From an analytical perspective (sensitivity, specificity, accuracy, negative predictive value and positive predictive value) and in combination with blood tests only three devices were evaluated positively. This means that after completion of ROSITA (2000) and ROSITA II (2005) quality and capacities of devices with regard to specificity and sensitivity were not substantially improved.

Cost-benefit analysis showed that increased drug driving enforcement based on roadside saliva screening is potentially beneficial – especially for countries with lower baseline enforcement level. Yet, if the drink driving enforcement will be decreased for the sake of increasing the drugged driving enforcement, the net benefit for road safety will decrease.

Classification of medicaments

DRUID will propose guidelines on prescribing and dispensing medicines that may have an impact on fitness to drive. These guidelines will address health care professionals like physicians and pharmacists. Furthermore, a categorization and labeling system has been developed. This four-step warning system will help health-care professionals to consult patients and patients to make a decision, whether to drive or not under the influence of a certain medicine. Dosage related issues are included into the system as well as the time of intake or the duration of the therapy. All relevant substances on the European market were examined and codified according to the specifications of the new system.
The practicability of the guidelines and the classification system is presently evaluated in a multi-centered study in three European countries.

Withdrawal and rehabilitation

The results of the questionnaire implemented in the respective work package confirm that the withdrawal legislation and practices in the EU are very heterogeneous. On the other hand, the set of policies is limited, the differences concern rather the hardness of the deterring approach. A consolidation of legislation would be helpful because the mobility in Europe is a cross-border mobility and requires cross-border approaches to combat traffic offences, including DUI. In DRUID a comprehensive set of data on European rehabilitation schemes has been analyzed and evaluated in order to give recommendations for best practice. The general conclusion is that rehabilitation measures and education might be useful and effective. A longer period of withdrawal of driving license does not necessarily lead to the desired results. It would be reasonable, to take the driver rehabilitation into account, when defining the duration of withdrawal, because rehabilitation may affect driving aptitude positively.

Dissemination

Dissemination of the DRUID results is an integral part of the project. One WP deals exclusively with this task. Dissemination takes place on many different levels. Within the consortium the website and meetings are main platforms for knowledge transfer. All deliverables are available for public, as far as they are approved by the Commission. The website offers an opportunity for documents sharing and joint activities during the working process.

The broader public will be separated into five target groups: patients, young drivers, physicians/pharmacists, politicians and the general public. For all these groups the results of DRUID are put to the test and appropriate key-messages will be filtered out. These key-messages will build the base for adequate information materials. For instance, clear

information about thresholds and the compulsory consequences of driving under the influence need to be communicated by public campaigns. Especially young people should be better informed about the risks of driving under the influence and legal regulations should be better communicated.

Relevant institutions and bodies have been involved early in the process (like EMA in the development of a classification system for medicines).

DRUID consortium was deliberately established as an alliance of as much key players in the domain of road safety research, as possible. Besides, as a result of our dissemination activities, all relevant agencies in the world are informed concerning DRUID activities. DRUID consistently informs international partners, e.g. from USA, Australia, Canada bilaterally as well as using platforms like ICADTS/ TIAFT, TRA, Fit-to-Drive Congresses, etc.

Europe could benefit from broad DRUID coverage and from the fact that all DRUID partners have an access to policy makers in their states. DRUID partners inform their national governments on DRUID achievements, and some countries (e.g. Belgium and Norway) have already taken into account the DRUID results while reconsidering their national regulations.

2.11 Fire safety of buses

Although the bus belongs to the safest traffic means, separate accidents can be particularly severe and concern many passengers. Particularly in case of fires a high number of injured and killed persons can be the outcome. Fire safety of buses therefore is of high importance. With the increase of synthetic or plastic materials as a material for the interior equipment of buses and coaches because of their good mechanical properties combined with low weight, the question arises whether the safety level has decreased in case of a fire during the last years - also compared to other means of transport. Because of the combustible and often easy ignitable plastics the main fire load in buses is no longer the fuel but the plastic materials. Besides the flammability of the equipments, the production of smoke, the smoke development and propagation and its toxicity for the people as well as the testing methods and limit values are of interest.

For those reasons a research project is carried out by BAM (Federal Institute for Materials Research and Testing) on behalf of BASt to examine and to develop effective and economically reasonable fire safety requirements for interiors of buses and for fire alarm systems which would improve the current situation and which would lead to amendments of current requirements. In particular, it is taken into consideration whether reasonable fire safety standards from other transport sectors could be transferred to busses. Also the assessment of the toxic potential of combustion products of interior materials in various representative fire scenarios including the derivation of limit values and the development of a proposal for the use of fire and smoke detection systems in buses are part of the project.

Figure 16: Fire of a doubledecker bus

2.12 Milled shoulder rumble strips

In Germany, there are almost 20,000 crashes each year with personal injuries on motorways. At about 20 % of these crashes the vehicle was running of the road to the right. Irrespectively the loss of control over the vehicle, due to an inappropriate speed or a conflict situation with another vehicle; a major part of these crashes is caused by inattentiveness or fatigue.

There are several active safety measures to prevent such crashes. One measure, which is running within the whole road network, is the lane departure warning system. So far, not every vehicle is equipped with this system, but the system is foreseen to be mandatory for at least some new HGVs to be registered after November 2015.

Despite the use of lane departure warning systems, the use of milled shoulder rumble strip is discussed. The advantage of milled shoulder rumble strips is, that their effect is independent of the vehicle type. In the framework of a pilot trial along a 35.9 km motorway section it could be shown, that the number of run-off road crashes by leaving the carriageway to the right, was reduced by 43 %. Due to this figure, the application of milled rumble strips on motorway shoulders is recommended, especially on route sections, which show a disproportionally high density of the crash type mentioned before.

The effect of rumble strips on rural roads for single-track vehicles is also analysed in the context of an investigation. The handling of bicycles and powered-two-wheelers from the perspective of traffic safety is of particular interest as there is currently only little data present on the behavior when cornering (tilted two-wheeler) and on the general stability riding for long

straight distances on rumble strips (issues concerning guidance and excitation of self-oscillations).

Figure 17: Rumble strip pilot trial

2.13 Vehicle lighting

Good lighting and visibility are basic prerequisites for traffic safety. It is therefore not astonishing that a lot of stringent regulations cover this field. However accident figures show that the share of motorcycle riders among the casualties does not decrease and that visibility is one contributing factor since the riders are sometimes overlooked by other road users. Another important aspect in the context of lighting is to avoid unnecessary glare which sometimes is a counterproductive side effect of higher luminous intensities.

2.13.1 Conspicuity of Powered-Two-Wheelers

The problem of conspicuity of motorcycles during the day is well known since many years and there are different international proposals to further enhance conspicuity by improvement of the frontal signal pattern of motorcycles – for night- and daytime driving. Conspicutiy is one part of the 2BeSafe project (2-Wheeler Behaviour and Safety), which officially started on January 15th 2009. It is a collaborative Project (co financed by EC-FP7/Transport) that basically aims to study the naturalistic driving behaviour of Powered Two Wheeler (PTW) riders in normal and critical riding situations. That includes the interaction between PTW riders and other road users. Its main objective is to target behavioural and ergonomics research, including research on crash causes and human errors, to develop countermeasures for enhancing PTW riders' safety. It is the world's first naturalistic riding study involving instrumented PTWs. It comprises 29 partners in 14 different countries in Europe, Israel and Australia, divided among research and academic institutes, end-users associations and industrial partners.

BASt is responsible for improvements in conspicuity and the development and evaluation of recommendations. After the development of design and manufacturing solutions for improving PTW conspicuity, taking into account characteristic driver behaviour in conflict situations, an abstract recognizing pattern for PTWs is defined, enabling other road users (e.g. car drivers) to clearly identify riders. At the end, a proposal for a uniform signal pattern or lamp configuration at the front of all motorcycles and riders will be outlined. Particularly using the findings of the studies on conflict situations, contrived possible lighting arrangements/positions to enhance conspicuity of PTWs during the day and at night are tested in a laboratory setting. For those tasks, experimental motorcycles with different lighting configurations of different colours as well as helmet lights, are used. Figure 18 shows one of the configurations.

Figure 18: T-Design for nighttime, daytime running lights are used as position lamps in this case

2.13.2 Bend (or curve) lighting for motorcycles

The usual lighting arrangement for motorcycles at the present time - the one (or two) driving-beam and passing-beam headlamp(s) - leads to an inadequate illumination of the road while cornering because of the tilt angle of the motorcycle. The improvement of road illumination has been neither investigated for a modified arrangement of the headlamps nor for possible future headlight systems with a compensation of the inclination angle of the motorcycle, and was therefore the subject of the study.

In the research project, done by BASt, two novel bend lighting systems for motorcycles were examined in real traffic situations with the help of volunteers in order to work out the advantages and disadvantages of the systems. Both, a retrofit bend lighting system for motorcycles with two additional headlamps (with driving- and passing-beam) and also a prototype bend lighting system – with some modifications currently available as BMW K1600 GT/GTL - with tilt compensation showed clear advantages in terms of an improved road illumination at night. The range of the spotlight, the illuminated roadway, the direction of the spot following the curve and the compensation of the inclination angle offer many advantages compared to conventional motorcycle headlights. Both systems, in particular the prototype system under examination, produce much less glare for the oncoming traffic and are therefore a contribution to the improvement of road safety. The questioning of the test persons on the basis of the experiments (test rides) showed a clear reduction of the stress perceived by the subjects during the test.

2.13.3 Automatically dipped high beam and rear view mirrors (high-beam assistant)

A project, carried out by Technical University of Darmstadt on behalf of BASt, focused on the reduction of glare by automatically dipping high beam and rear view mirrors. To analyse glare through opposing vehicles a free field test setup had been developed which allowed measuring in a dynamic driving situation. To determine the influence of glare the contrast sensitivity of a driver was used as dependent variable: The higher the glare illuminance, the higher is the absolute threshold of viewing an object. This classical practice was realised with a head-up-display in a car to guarantee the rating of glare in realistic or virtually realistic driving situations. A speech recognition system allowed the driver to evaluate any situation verbally, so he was not hindered too much in his driving and viewing task.
The viewing task was e.g. the estimation of the position of a square relative to a bar repeatedly shown in different positions in the Head-Up-Display (HUD) (see figure 19).

Figure 19: Visual task with a square to be detected in different positions relative to a bar

The viewing task was performed while the test person converged to an opposing car with powered high beam. When the test person failed to solve the viewing task, the physical impairment of glare was considered to be intolerably high. A tolerable amount of glare is the impact on the visual system by dipped beams in 50 m distance which is inevitable in normal traffic situations. The same amount of glare with high beam is reached in a distance of approx. 450 m, therefore this is the distance where high beam assistant systems should dip.

Also the psychological glare has been evaluated and most of the test persons wished the other car to dip the high beam at 500 m to 550 m distance.

The HUD viewing task has also been performed to determine the glare of subsequent cars, which is perceived through the driving mirrors (Figure 20). Since this part took place in the laboratory in a static and stylised environment, smaller threshold luminances could be detected by the probands. Obviously the driving task is missing, so a precise transfer into realistic driving situations is not possible. But by this way also small declines in the luminance threshold evoked by little glare illuminances have been measureable. As a result, a realistic specification for any automatically dipping mirror system is to keep the glare illuminance on the driver's eye under 2 lx. The project results will be partially introduced as amendments to ECE-Regulations in Geneva by Germany.

Figure 20: Experimental set-up for determining rear glare

2.14 Winter tyre obligation

Since December 2010 -just before the winter period in Germany- the Ministry of Transport Building and Urban Affairs concretised the existing mandatory tyre law (introduced in 2006) of using of winter tyres while driving on roads covered with snow, ice and/or snow mud. Only M+S labeled tyres and snow flake marked tyres may be used under these weather conditions, passenger cars on all 4 tyre positions and trucks only on the drive axles. In the last winter period 85% of the passenger cars were already equipped with winter tyres and nearly all trucks. This measure will increase road safety and will avoid blocked roads in winter time.

ESV CONFERENCE 2011 - ITALIAN GOVERNMENT STATUS REPORT

Dr. Antonio Erario
Head of Division, International Regulatory Affairs
Ministry of Infrastructure and Transport
Department for Land Transport
Italy

ABSTRACT

This paper provides an overview of the main results achieved by Italy in the field of road safety during recent years. It focuses on the follow-up of the "National Plan on Road Safety", adopted nine years ago and subsequent introduction of new provisions in the "Highway Code".

After a general descriptions of main road safety results, this paper describes the principal measures adopted during the last period, focusing on regulatory policies and enforcement.

Weak factors and the main unresolved problems are described: regional and local gaps, safety of urban areas, high risk road network, urban crossing roads, two-wheeler safety, vulnerable users.

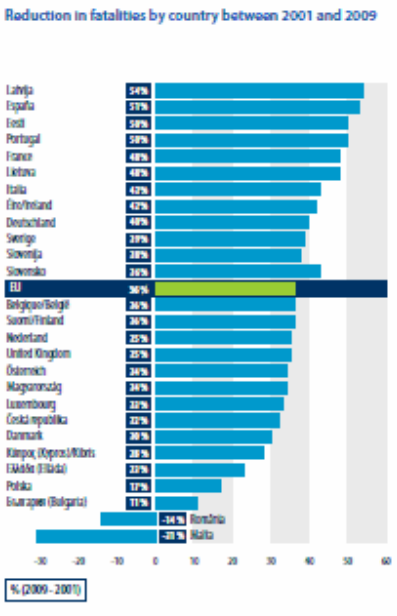
A brief descriptions of the research activities in the field of vehicle safety is given as well as a summary of the main recommended actions to be taken to improve road safety.

GENERAL

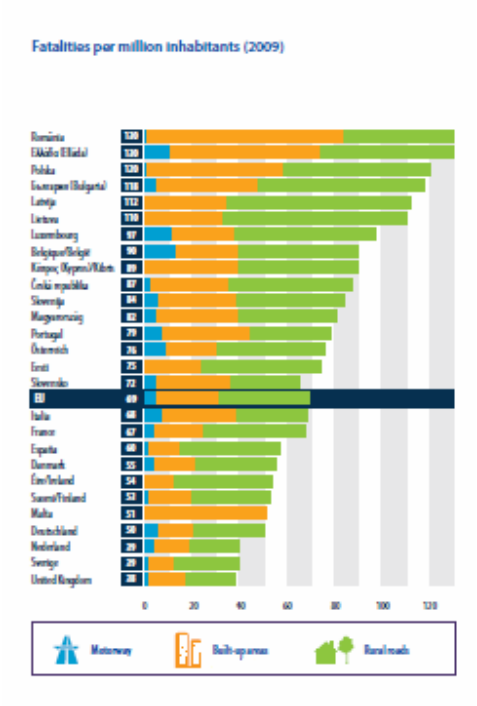
Road Safety in Italy

In the period 2001-2009, Italy recorded a 43 % reduction of fatalities which is the fifth best value in the European Union (EU27).

According to the report presented to the Parliament by the Ministry of Infrastructure and Transport, Italy is progressively bridging the gap with the other Member States which originated in the period 1990 - 2002.



In spite of the progress made, Italy remains an European country with high number of fatalities (4,237 in the year 2009); Therefore, further and continuos improvements are necessary to become one of the best five countries in Europe.



The present report describes the principle measures adopted at national level to improve road safety in Italy, makes an analysis of the principle problems and suggest some actions to be taken.

THE MAIN ADOPTED MEASURES

The recent improvements in road safety are manly due to the following factors:

Regulatory policies

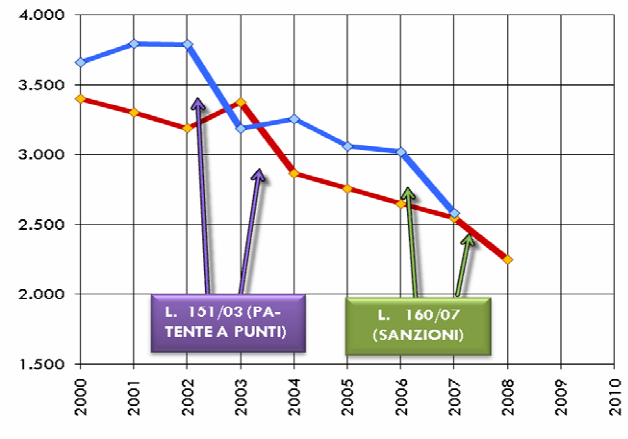
The national highway code has been amended several times. In particular three major changes relating to
- the introduction of a penalty point system based driving license (Law 150/2003);
- revision of penalties (Law 160/2007);
- more action against drinking and driving (Law 120/2010)

need to be mentioned.

During the first two semesters of application of laws.151/03 and 160/07 a reduction of 1846 deaths has been recorded. This represents about the 86 % of the reduction of fatalities recorded between 1st January 2003 and 30 June 2008.

In the six preceding years (1997-2002) no reduction had been recorded.

THE EFFECT OF NATIONAL REGULATORY POLICIES
ON THE FATALITY RATE



_____ 1st semester _____ 2nd semester

Assessment on the effect the last amendment is not possible yet (Law 120/2010), anyway the major measures concern:

- Novice drivers (holding a driving license for less than three years), young people aged up to 21 and professional drivers (taxi, truck, bus) can not drive if they have taken alcohol or drugs: → **no alcohol tolerance, BAC= 0 g/l**;
- More severe penalties when driving under the influence of alcohol or drugs: → **drivers can be arrested when BAC is more then 0,8 g/l**;
- Drug tests for novice drivers and professional drivers (at the time of renewing the driving license): → **no driving license for drivers taking drugs**;
- Motorway rest areas are not allowed to sell spirits from 10 p.m. to 6 a.m. During the night hours (2 a.m. to 6 a.m.) it is also prohibited to sell any kind of alcoholic beverage : → **no alcohol on motorways**;
- Restaurants, bars, cafes, discos, nightclubs, cannot sell alcohol after 3 a.m. If they are open after midnight, they should be provided with an alcohol test device which has to be made available to customers who want to check their state of fitness to drive before leaving : → **no alcohol in the night**.

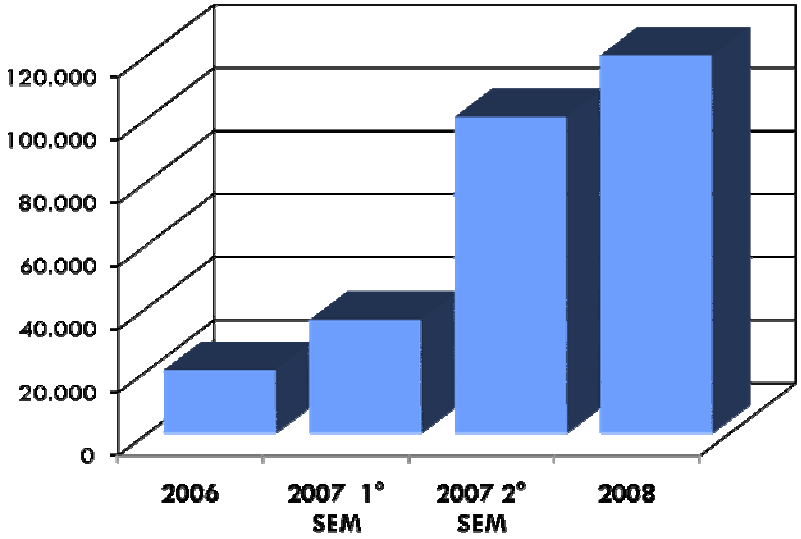
<u>Better Enforcement</u>

Compared to the year 2006, the number of controls carried out on the roads has increased .

In particular, starting from 2006, the number of checks on drink and driving, compared to the number of driving licence has increased by six times (from 20,000 to 140,000 controls per month).

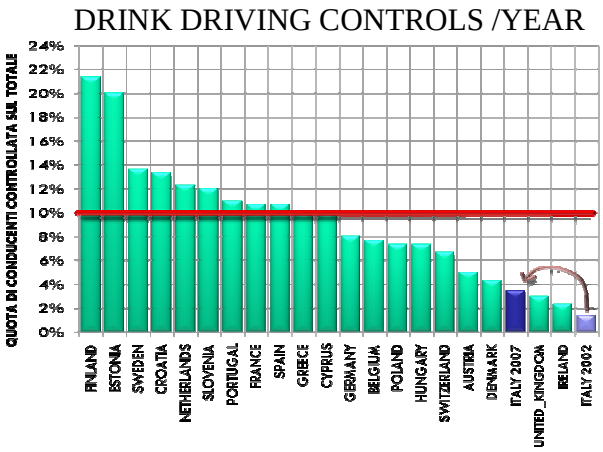
As for other European countries, automatic controls, made by cameras and radars have been increased and the results are quite encouraging.

CONTROLS/MONTH



The increasing number of controls has allowed to reach the target to make drivers aware of the certitude to be punished in case of high risk behaviour (e.g. drink and driving, speeding, aggressive driving, no use of safety belts and helmets).

% OF CONTROLLED DRIVERS



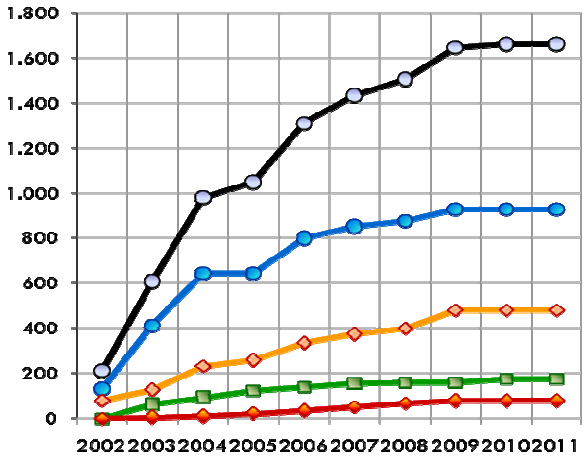
On some of the motorways network, the introduction of the “Tutor” system that records the average speed of every vehicles passing through a specific road section, has delivered a 19% accident reduction as well as 51% fatalities reduction.

At present the Tutor system is installed on about 20 % of the highway network.

<u>The adoption and implementation of Road Safety National Plan</u>;

The plan, adopted in the year 2002 has been progressively implemented and financed at national and local level.

ROAD SAFETY PLAN FUNDING (MILLION €)



The last budget law introduced limits to public investement due mainly to economic crisis and to budget constraints.

<u>Better road safety risk awareness</u>.

The adoption at national and local level of information campaigns has increased driver's awareness with regard to drink driving, speeding, use of helmets and safety belts.

WEAK FACTORS

Road Infrastructure Inadequacy

The road network in not adequate to the present traffic flows and characteristics.

During the last 30 years we have passed from an average of 50 vehicles/km to 110 vehicles/km.

Italy has the highest vehicle/inhabitants ratio in the EU (846/1000).

Although the number of motor vehicles has increased from 22,1 millions to 51,9 millions the road network has not changed substantially.

Moreover, the quality and the maintenance degree of the existing network (with exception of motorways) needs to be improved as well as the road signs which are not always well maintained and well positioned along the roads.

Traffic regulations

Sign management plans are not adopted in a coordinated way , in urban area as well in rural areas. They should be adopted taking in due consideration road safety analysis (e.g traffic flows, black spots) rather than public opinion requests.

Education

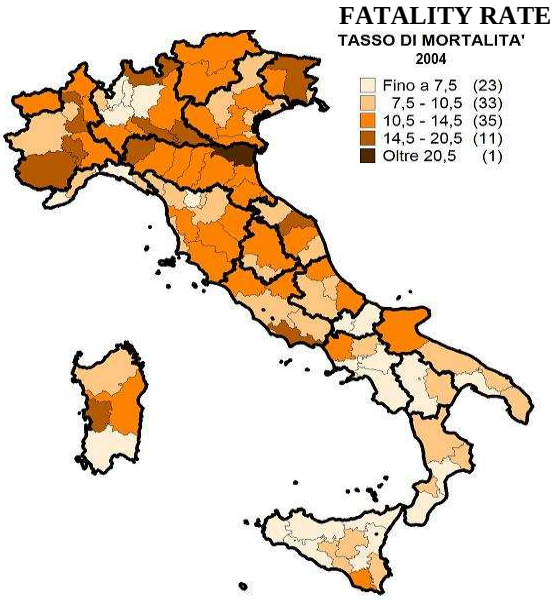
Better education is needed starting at school level and including certain categories of citizens and those people responsible for road safety.

MAIN UNSOLVED PROBLEMS

As already said, in spite of the improvements made between 2003 and to 2007, Italy presents some safety problems which still need a solution.

Regional and local gaps

Road safety risk index varies among Italian cities so that one citizen may have seven times more probability to be involved in an accident according to the region he/she is living in.



The fatality rate varies from 3 to 21 dead per 100,000 inhabitants.

Between 2002 and 2003, 12 provinces recorded an increase of fatalities between + 10% and + 50% while 10 provinces recorded abatements between -30% and -50%. In other terms, one part of Italy has difficulties on maintaining the step of Europe while the other can achieve both, the European and national goals before the year 2010.

Urban areas

Urban areas represent a major problem since the 45 per cent of fatalities recorded in 2009 happened there. In summary:

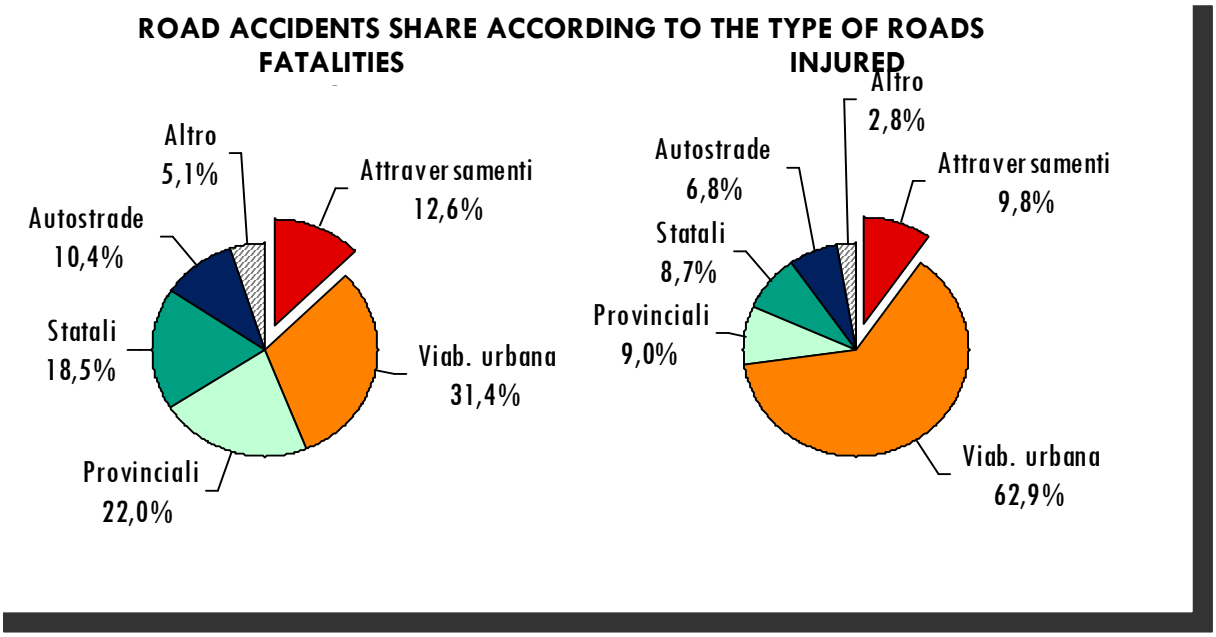
1,892 fatalities (45% of total)
223,166 injured, (73% of total)

High risk road network

Following a study made by the Italian Ministry of Infrastructure and Transport, a network of about 6.000 km roads presenting the highest level of road accidents has been identified; Economic resources will be invested on these selected roads, on the basis of road safety priorities.

Urban crossing roads

A high victims concentration is due to accidents happening on roads crossing urban areas. This is particularly evident on roads crossing villages where road traffic conditions change completely passing from rural to agglomerate areas.
712 fatalities have been recorded in 2006, namely 12,6% of total amount, 32,700 injured (9,8%) with a social cost of 3.399 million Euros (10,5%).



urban roads urban area crossing roads national roads

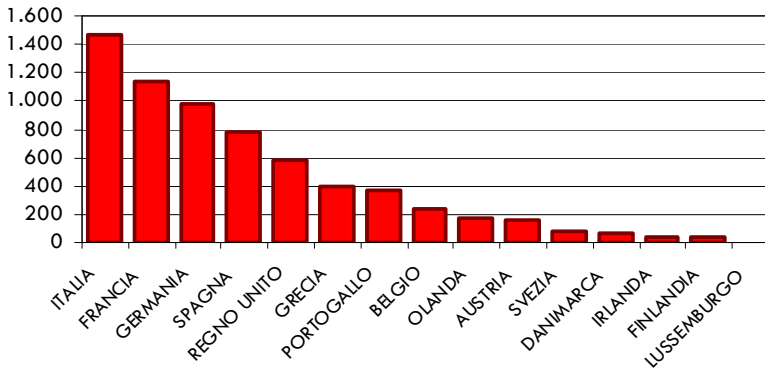
highways provincial roads other roads

Two wheeler mobility

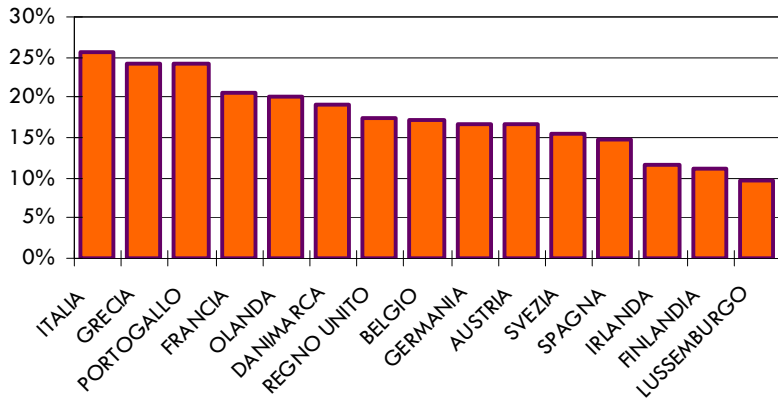
Italy has the highest number of victims in the EU15. In fact, road accident involving two wheeler users caused in the year 2007 1.540 fatalities (about 30,0% of total) and 90,551 injured (27,8%) with a social cost of 8,812 million Euros (28,3%).

About 60% of fatalities and 80 % of injured people are recorded in urban areas; Therefore, a clear link between urban area road safety and two wheeler road safety exists.

Number of fatalities – motorcycles and mopeds



Percentage of fatalities – motorcycles and mopeds



The typical victim of a two wheeler accident is represented by an adult citizen using the vehicle to commute to and from the working place, running on an urban road at low speed.

Pedestrians, cyclists and elderly people

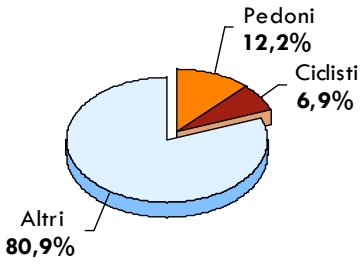
Italy has recorded the highest number of fatalities among pedestrians.
As for two wheelers, these accidents mainly happen in urban areas determining a clear safety link between urban areas and road vulnerable users

The constant increasing of number of elderly people has made the safety of this category of strategic importance.

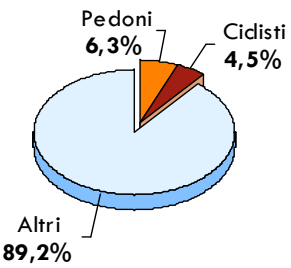
In the year 2007 road accidents involving elderly people have led to:
1,105 fatalities (21,5% of total) which is the highest rate in the EU
27,000 injured (8,4%) with a social cost of 3.553 million Euros (11,4%).

VICTIMS AMONG PEDESTRIANS AND CYCLISTS

Fatalities

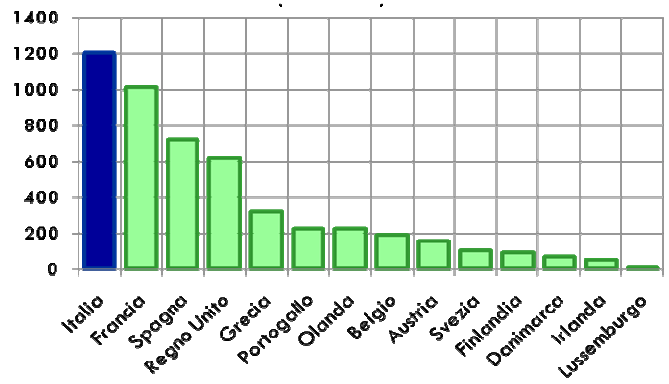


Injured



cyclists pedestrians

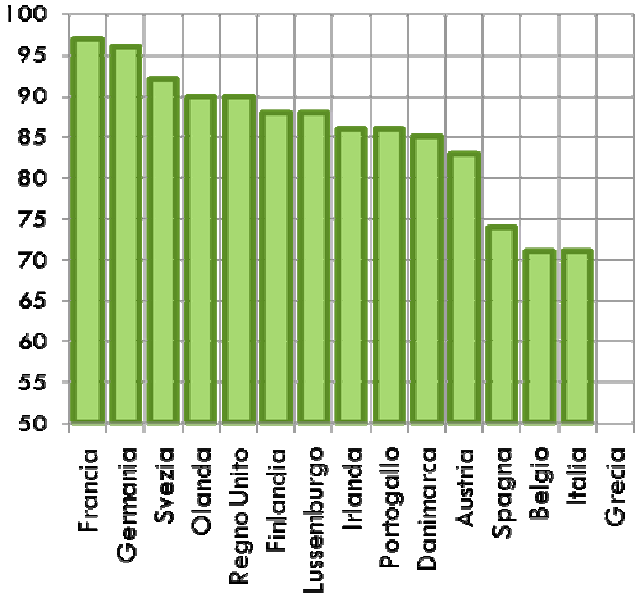
FATALITIES OF ELDERLY PEOPLE



Use of safety belts.and helmets

Italy has the lowest rate in EU regarding the use of safety belts (71.6 %)
According to the European Transport Safety Council (ETSC) the use of seat belts by all drivers and passengers would save about 800 lives every year.

USE OF SAFETY BELTS (% RATE)



Regarding the use of helmets the gap among regions is quite evident. In the northern and central regions the percentage of use of helmets is quite close to 100 per cent while in the southern regions

the available data show lower percentages which can reach 50 per cent at local level.

VEHICLE SAFETY RESEARCH

Research in the field of vehicle safety is mainly carried out in the framework of the activities of the European Enhanced Vehicle-safety Committee – EEVC of which Italy is member.

Researches conducted by EEVC are taken into account by the European Commission when preparing new legislation on road vehicle safety and by the UNECE which adopts technical regulations under the framework of the 1958 and 1998 Agreements.

The EEVC technical work is made by nine working groups, six of them dealing with passive safety, two with active safety and one with accidentology.

In the future, further progress in vehicle safety is expected more, in the area of active safety than passive safety.

In the field of child safety it is worth mentioning the CASPER project (Child Advanced Safety Project for European Roads) aiming at reducing fatalities and injuries of children transported in cars. The project, co-founded from European Community's Seventh Framework Programme, is managed by a consortium of 15 partners from 7 countries bringing together universities, research centres and car manufacturers (PSA, TUB, Universitè de Strasbourg, IDIADA, INRETS, Loughborough University, FGA, Medizinische Hochschule Hannover, Chalmers, Bast, TNO, Humanetics, Ludwig-Maximilians-Universität München, CESAR, Verein für Fahrzeugsicherheit Berlin), in the fields of automotive and human factors research, accidentology, biomechanics research, devices & technology for CRS (Child Restrain Systems).

Two are the main objectives of CASPER:

- to improve the number of correctly restrained children.
- to improve the quality of the restraint systems through the improvement of the tools (dummies, sensors, models,…) that can be used to design and develop new systems according to new test procedures that are more realistic because based on the real-life observations.

For more info: http://www.casper-project.eu/

An important task accomplished by Italian Partner is the collection of information on children restraint in cars through an extensive internet survey with the objective of better understand this topic and make proposals for dissemination of the findings and subsequent actions to be taken.

In the field of frontal impact protection the main research programme in Europe is the FIMCAR project (Frontal IMpact and Compatibility Assessment Research). Also this project is co-founded from European Community's Seventh Framework Programme and it is managed by 19 partners, European universities and research centres, car manufacturers and one supplier of loadcellwall instrumentation :
TUB, BAST, AB Chalmers, VTI, DAIMLER, FIAT, CRF, FTSS, IAT, IDIADA, GME, PSA, RENAULT, TNO, TRL, UTAC, VOLVO, VW, TTAI .

For the real life assessment of vehicle safety in frontal collisions the compatibility (described by the self protection level and the structural interaction) between the opponents is crucial.
Although compatibility has been analysed worldwide for years, no final assessment approach was

defined. Taking into account the EEVC WG15 and the FP5 VC-COMPAT project activities, two test approaches are the most important candidates for the assessment of compatibility. Both are composed of an off-set and a full overlap test procedure. However, no final decision was taken. In addition another procedure (tests with a moving deformable barrier) is getting more and more in the focus of today's research programmes.
Within this project different off-set, full overlap and MDB test procedures will be analysed to be able to propose a compatibility assessment approach, which will be accepted by a majority of the involved industry and research organisations, in this moment the four candidate test procedures are :
PDB : Progressive Deformable Barrier (offset test)
MPDB : Mobile Progressive Deformable Barrier (offset test)
FWRB : Full Width Rigid Barrier
FWDB : Full Width Deformable Barrier
The development work will be accompanied by harmonisation activities to include research results from outside the consortium and to early disseminate the project results taking into account recent GRSP activities on ECE R94, Euro NCAP etc.
The FIMCAR project is organised in six different RTD work packages. Work package 1 (Accident and Cost Benefit Analysis) and Work Package 5 (Numerical Simulation) are supporting activities for WP2 (Offset Test Procedure), WP3 (Full Overlap Test Procedure) and WP4 (MDB Test Procedure). Work Package 6 (Synthesis of the Assessment Methods) gathers the results of WP1 – WP5 and combines them with car-to-car testing results in order to define an approach for frontal impact and compatibility assessment (*For more info : http://www.fimcar.eu/).*

ACTIONS TO BE TAKEN

Italy has been experiencing the greatest and most relevant amelioration process in the field of road safety during the last 30 years, which will make it possible to re-align with the other EU countries.

A series of actions have been recommended by the transport administration and are being considered at political level.

First of all, in order to improve the effectiveness on road safety it is necessary to reinforce the action and ensuring a better coordination at central, regional and local level

In this respect a new Directorate General for Road Safety has been created within the Ministry of Infrastructure and Transport. This new organisation is linked to the corresponding regional offices which should make it possible to deal with road safety in a more systematic way.

Secondly, it s clear that the enforcement action is producing positive effects; therefore we expect to continue to increase the number of controls on the roads with a better and dissuasive enforcement of traffic rules.

Another priority will be the creation of a road safety culture, starting from school level with the aim of making the young population more aware of the need of careful and responsible drive. This priority should also concern administrations dealing with road safety in order to train better the exiting human resources and prepare the new professionals to better deal with the subject.

The Road Safety National Plan has strongly recommended the adoption of a monitoring network based on local administrations and coordinated at national level. The aim of the monitoring would be

to know better the state and the evolution of road safety, to know the road safety measure adopted during the years and the results which have been achieved, to assess the effectiveness of the adopted measures.

GOVERNMENT STATUS REPORT OF JAPAN

Ryosuke Itazaki
Director,
International Affairs Office,
Engineering Planning Division,
Engineering and Safety Department,
Road Transport Bureau,
Ministry of Land, Infrastructure, Transport and Tourism of Japan (MLIT)

TRENDS OF THE ROAD TRAFFIC ACCIDENTS IN JAPAN

The number of fatalities (those who died within 24 hours) resulting from traffic accidents in 2010 was 4,863. This represents the tenth consecutive year that the number of fatalities has been decreasing. This number was below one-third the 16,765 fatalities in 1970, which was the year in which the number of fatalities reached a peak. In addition, the number of accidents resulting in injury or death and the number of injured persons decreased for the sixth consecutive year in a row since 2004, when the numbers were at their worst.

However, the number of fatalities and injured persons and the number of accidents resulting in injury remained high in 2010, as there were approximately 900,000 fatalities and injured persons, and approximately 730,000 accidents resulting in injury or death.

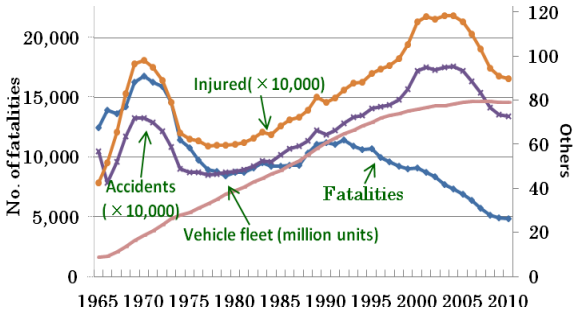


Figure 1. Trends of the road traffic accidents in Japan

With regard to reducing the number of traffic accidents, in order to achieve the national government's mid-term goal of "reducing the number of fatalities from traffic accidents to below 5,000 people by 2012" as indicated in the Prime Minister's policy speech in 2003, the targets of reducing the number of fatalities to below 5,500 and reducing the number of injured persons to below 1 million people by 2010 were established in the Eighth Fundamental Traffic Safety Program for 2006 to 2010.

This mid-term goal by the national government of reducing the number of fatalities to below 5,000 and the targets in the Eighth Fundamental Traffic Safety Program were reached two years in advance.

Based on these circumstances, the national government is now considering to set the new targets of reducing the number of fatalities to below 3,000 (those who died within 24 hours) and reducing the number of fatalities to below around 3,500 (those who died within 30 days) people by 2015 in the Ninth Fundamental Traffic Safety Program for 2011 to 2015.

The environment around road transport vehicles is beginning to change greatly because of the change of traffic accident victim group that is reflected from development of aging society and the introduction of new technologies including electric vehicles aiming at realizing of low carbon society.

Therefore, WG on the Technology and Safety for Vehicle of Council for Transport Policy of MLIT is now considering setting a new target that aims to reduce the number of fatalities by measures of vehicle safety until 2020 and to make a conclusion of measures and direction of policy to reach the new target.

Examples of measures are following,

(1) Reduction of injury by traffic accident in which senior citizen and pedestrians are involved

－Driving support system for senior driver

- Dissemination of ITS technologies that can detect pedestrian and other vehicles.

(2) Responding the development and dissemination of new technologies such as EV

- Securing of safety of battery and Measures against QRTV
- Safety measures against micro mobility such as application of collision safety and introduction of preventing safety technologies

FUTURE RESEARCH IN FINDING SOLUTIONS TO THE SAFETY PROBLEMS IDENTIFIED

To reduce the number of traffic accidents, approaches will be made towards the following measures upon speculating future changes in social structures, such as future developments in IT and the progression of declining birthrates and an aging society.

- Promotion of safety measures for pedestrians;
- Promotion of neck injury prevention measures;
- Introduction of standards on crash compatibility;
- Research on advanced technologies, etc.

Concrete approaches regarding each of the measures are introduced below.

1. Promotion of safety measures for pedestrians

With regard to accidents involving pedestrians, which account for a high percentage of the number of fatalities caused by traffic accidents in Japan, it is necessary to implement popularization and promotion of pedestrian protection performance standards. As a result, with regard to measures for pedestrians, pedestrian head protection standards were introduced in 2004, and reviews are being conducted on the introduction of pedestrian leg protection standards. At the same time, a global technical regulation for pedestrian leg protection is now being discussed at GRSP under WP.29 and Japan continues actively contributing to that activities.

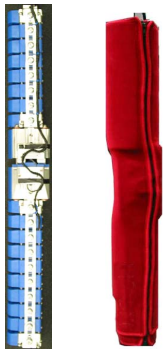


Figure 2. FLEX-PLI

According to rapidly spreading of hybrid cars, Japan judged that measures are needed to address the quietness of hybrid cars. And then the MLIT set up a study committee to investigate the problem of quietness.

In 2010, this committee reported to the MLIT on a future direction and specifically recommended that these vehicles should emit a sound. Based on these results, the MLIT published a guideline on Approaching Vehicle Audible Systems (AVAS) for short, which are designed to solve the quietness of HVs and similar vehicles.

WP.29 established a guideline in March 2011 based on Japan's guideline and now expects to develop it as a global technical regulation (gtr).

Figure 2. Live demonstration of sound devices that could equip "silent cars" at UNECE

2. Promotion of neck injury prevention measures (standardization of dummies)

Accidents involving neck injury account for

more than half of the total number of accidents, and as there is an increasing trend in the number of such accidents in recent years, the enhancement of standards for headrests, etc. is being promoted as measures for neck injuries.

At the same time, with regard to assessments of whiplash injuries, which 80% of occupants in rear-end collisions suffer, the mechanism behind the occurrence of whiplash is complex, and as a result, there is not enough scientific clarification and it is also unclear as to which dummies should be used and what items to assess.

In particular, with regard to dummies, there are concerns regarding the consistency of assessments due to differences in structures, etc. of the dummies, and it is necessary for dummies to be standardized by having the research institutions, etc. of each country make approaches by contributing to efforts to elucidate the mechanism behind the occurrence of whiplash injuries and decide on assessment standards and indicators.

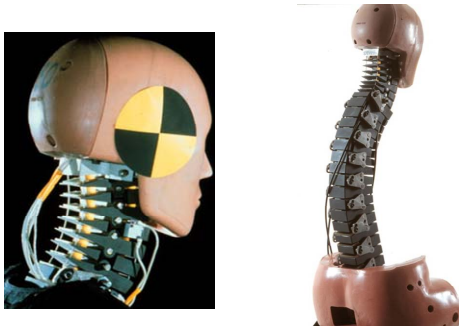


Figure 3. Standardization of dummies

3. Introduction of standards on crash compatibility, etc.

In addition to the above, crash compatibility measures for accidents involving frontal collision are also one of the passive damage mitigation measures for which approaches should be made. Japan considers measures for mini vehicles as being necessary. For the short-term, reviews are currently being conducted on the installation height of structural members so that the structural members interlock when there is a frontal collision.

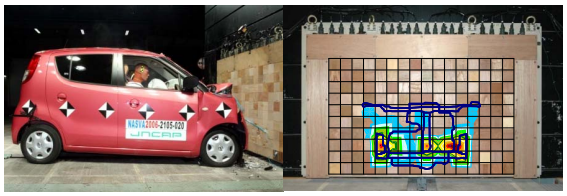


Figure 4. Crash Compatibility

Standards relating to performance for protecting occupants from electric shock after the collision of an electric vehicle or hybrid vehicle were introduced in 2007, and based on these regulations, UNECE regulations were established at WP.29 in 2010.

Regarding electric vehicle, establishing a safety regulation against Rechargeable Energy Storage System (RESS) is now being discussed at WP.29. Japan is going to contribute to this activity continually.

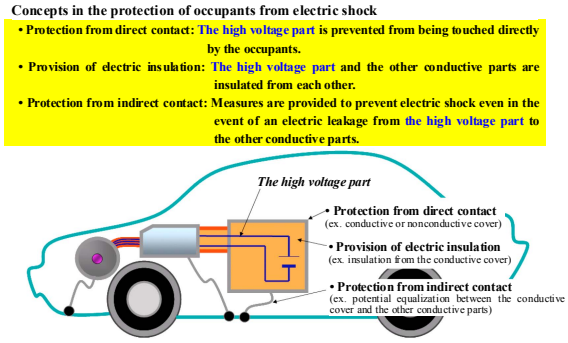


Figure 5. Concepts in the protection of occupants from electric shock

4. Research on advanced technologies

To prevent errors by drivers before they occur and decrease the number of accidents resulting in death and injuries, Japan has, with regard to ASVs, which are vehicles equipped with a system for assisting the driver to drive safely that makes use of advanced technology, established the ASV Project, which is a project to promote the development, practical application, and popularization of technology related to ASV, in 1991, and has been progressing with this project through joint efforts by industry, academia, and government.

For example, with regard to ASV technology that uses communications technology,

technological developments are being promoted in the automobile industry through the implementation of experiments on public roads. In 2009, a Large-scale Field Operation Test on public roads using approximately 30 vehicles equipped with inter-vehicle communications was conducted based on cooperation between the public and private sectors. Based on this Test results, the MLIT will be planned to establish design requirements for practical system utilizing communications.

Figure 6. Communication-based driving assistance system for safety

From among the ASV technologies that are already mature, those with large effects in damage mitigation and accident reduction and those for which there are large social needs should be disseminated in an early manner, and thus, active dissemination measures that include means for incentives are necessary.

The MLIT established a technical guideline for the damage mitigation braking system in 2003, and reviews were conducted on this system regarding further measures that bring compulsory installation.

Regarding this technology, WP.29 is now discussing to establish a safety regulation as an ECE Regulation on Advanced Emergency Braking System (AEBS). Japan is actively contributing to this discussion.

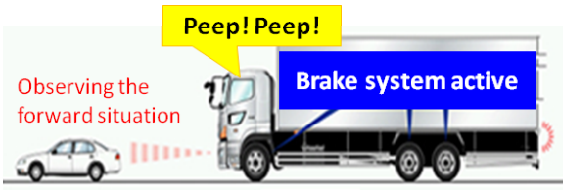


Figure 7. Illustration of activating AEBS

PUTTING SAFETY TECHNOLOGIES TO WORK

The following table is a list of ASV technologies that are being put to practical use. Several ASV technologies, such as the lane-keeping assistance system and high-speed adaptive cruise control, have already been put to practical use, and are equipped in commercially-sold vehicles.

Table 1. Commercialized technologies from ASV Project

Common Names of ASV Technologies	2007	2009
Variable light distribution (AFS)	212,575	206,129
Nighttime forward pedestrian advisory system (Nighttime pedestrian warning)	186	369
Zigzag driving advisory system (Zigzag warning)	113,772	286,597
Forward vehicle collision warning system (FVCWS)	9,243	35,437
Forward collision damage mitigation brake control system (Damage mitigation braking system)	23,334	35,961
Constant-speed cruising / following distance control system (ACC)	28,253	35.001
Lane keeping assistance control system (LKAS)	2,660	4,438
Electric stability control system (ESC)	395,559	705,939
Total annual production	4,175,007	3,788,552

The MLIT has been examining the ideal way of the safety measures from the viewpoint that introduces regulations with high effect using the cycle of vehicle safety measures shown in the figure below.

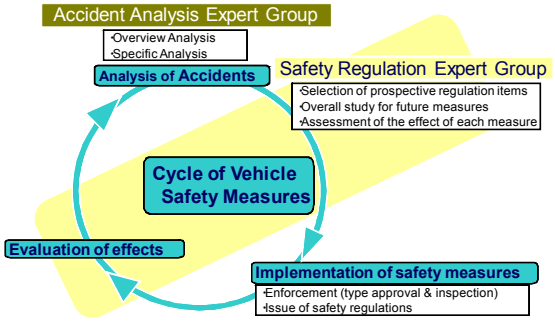


Figure 8. Study process before & after rulemaking

IDEAS FOR POTENTIAL COLLABORATIVE RESERCH INTER NATIONALLY

Japan would like to collaborate internationally to establish regulation against head restraint because accidents involving neck injury account for a high percentage of the number of fatalities in Japan as mentioned above. And also global technical regulations on new technologies like QRTV, RESS, AEBS and ITS in general could be established and in order to do so it would be needed to collaborate internationally by doing so, we could surely promote smooth diffusion of safe and convenient vehicles with equipments utilizing above mentioned advanced automotive technologies.

CONCLUSION

Measures that are being taken in Japan have been described above, but in order to promote international harmonization in the aspects of further advancing safe and environmentally friendly vehicles in the future, it is perceived that approaches made in coordination with the ESV Conference, WP.29, ITS World Congress, etc. will become increasingly important.

GOVERNEMENT STATUS REPORT - POLAND

Wojciech Przybylski
Instytut Transportu Samochodowego

INTRODUCTION

The following report contains information on the progress achieved in Poland with regard to aspects of road traffic safety since the time of 21th ESV Conference (Stuttgart, 2009). This period is generally characterised as the intentional effort towards the traffic safety items within all its main system fields taking into account priorities drawn from analysis of domestic and international accident statistics. The current accident statistics for last ten years are given on Figure 1, and Figure 2 and in Table 1.

In 2010 on polish roads 38 832 road eccidents occured resulted in 3 907 fatalities and 48 952 injured persons. The Police was informed of 416 075 road collisions which in relation to 2009 gives:

- 5 364 less road accidents (- 12,1%),
- 665 less fatalities (- 14,6%),
- 7 094 less injured (- 12,7%),
- 34 306 more collissions(+ 9%).

Even if the last two years on our roads were not that bed still Poland demonstrate the higher level of danger on the roads in comparison to other EU countries. Since 2001 we noticed 29% decrease of the number of fatalities (half of that in 2010) while the average figure in EU is 35% in the decade. The comparison of plans and reality regarding road safety change in respect of fatalities is shown on Figure 3

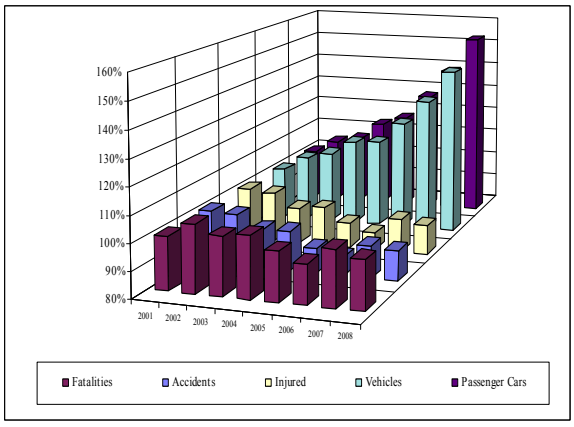


Figure 1. Road Accidents and Vehicle Stock Percentage in Poland in the Period 2001-2010 (2001=100%)

By: Anna Zielińska, Motor Transport Institute

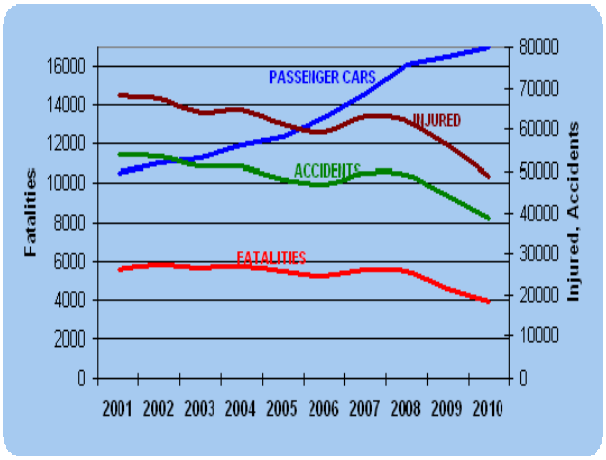


Figure 2. The result of Road Accidents and Vehicle Stock in Poland in the Period 2001-2010

By: Anna Zielińska Motor Transport Institute

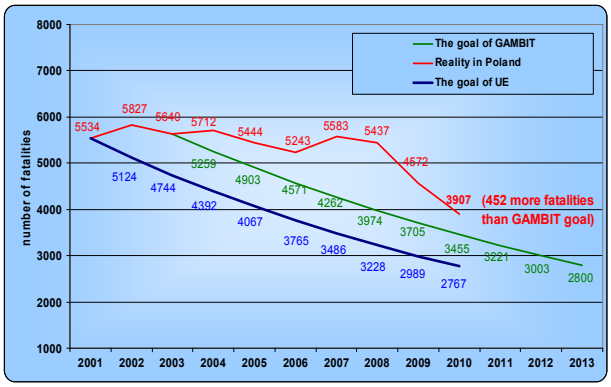


Figure 3. Plans and reality in the last decade.

By: Anna Zielińska Motor Transport Institute

From the accident statistics deeper analysis it still appears that in the majority of cases the human behaviour is the reason of majority of road accidents. Two main groups of road users – drivers and pedestrians are sharing this fatal record in the rate of 5 to 1 being involved as causal factor in more than 97% of accidents.

THE PROGRESS IN THE FIELD OF VECHICLE RELATED FACTOR

In last 2 years we kept accepting changes related to the technical progress in European and internationally agreed technical requirements and putting them into legislation of our type approval system, which is fully unified to EU. It is to be

stressed that the current harmonisation level of Polish technical vehicle requirements was reached by the date of EU accession and all important safety and environmental items regarding motor vehicles are already in force. Moreover there is also a visible progress of accreditation action inside the research and testing domestic third party laboratories harmonising their quality systems with future

With regard to international vehicle construction requirements Poland continues to present the opinion of the suitability of 1998 Global Agreement, recognizing it as an effective way to harmonize world-wide important technical requirements for road vehicles. Having continued with a membership of EEVC from the beginning of 2003, we accept the initiative to establish the worldwide after IHRA solution, enabling better global harmonisation of vehicle technical requirements. Our membership in EEVC Steering Committee is continued in activity in two Working Groups i.e. WG 19: HMI and WG 23: Bus Frontal Collision. It is worth mentioning also the participation in international co-operation of Polish in virtual safety WG in the frame of EU Commission activities.

With regard to the system of Periodic Technical Inspection of in-use vehicles, we are also in the process of introducing permanent improvements to its quality and objectivity of checks. Our presence in renewed CITA working groups and new EU Commission WGs gives us on one hand the possibility to make positive input to international activities enabling better standards for PTI and in return to have access to latest achievements of CITA members works. The PTI checking equipment continues to be in Poland under certification and we perform with the basic level course and advanced training skills of PTI inspectors. In result of more stringent requirements regarding the personnel qualification and equipment quality, the rate of traffic accidents due to bad technical state of vehicles, is in our estimations keeping the level of around 0.6%. Moreover, there are already around 1000 PTI stations of highest technical level having the care agreement with Motor Transport Institute and Polish Chamber of PTI, based upon which they receive the latest available data and information regarding professional items. The decision on the accession of Poland to the UN 1997 Agreement, on the international PTI, had been taken but not yet finalised.

THE PROGRESS IN THE FIELD OF HUMAN RELATED FACTOR

Our National Road Safety Council pays the greatest attention to the problem but had, by now, succeeded in limited number of fields. The most important result was achieved in continuation of reduction the relative rate of accidents caused by drunken road users by around next 5%, during last 2 years. Even if we keep good position among evaluated countries **t**his is still not satisfactory enough and leads towards more stringent legislation.

The other activity in the field of human factor continued in the last 7 years, was aiming at road education of children, promotion of safety of non protected road users, improvements of driver training and scientific co-operation in **ROSE 25, SHLOW (ETSC project), EUCHIRES, DRUID, ERIC, DaCoTA**, **SAFE WAY 2 SCHOOL, MODULE CLOSE TO, SOL, ISEMOA, BESTPOINT, ICARUS, Polish RSO** as well as accident database IRTAD and CARE.

The specific new programme (based on diet law) relating to speed control has been launched at the beginning of 2009. According to its rules more than 400 new speedcameras were mounted on our roads and special centre for collecting the related information was organised and perform effective operation. It is also to be noticed that points of mounting the speed caperas are now located in places having noticeable high rate of serious accidents.

THE PROGRESS IN THE FIELD OF ROAD RELATED FACTOR

W noticed some progress in this field but still being far from our expectations. We have still so far a low rate of classified motorways, which is being 0,15 km /100 km², while in the "old EU" countries it is 1,58 km/100 km², this figure speaks for itself!

Fortunately there are some signs of spring in this specific area. During last two year period the road maintenance service, managed to improve next 20% of Polish existing road network classified as „national" (38 000 km in total according to EU classification). Taking into account more or less stabile growths of number of vehicles on the roads it is not enough by far.

Now some information on the continuation of specific national road safety programme named "Roads of trust" which was started in 2007. The strategic aim of the programme is to reduce by 2013 the number of deaths on national roads of 75% in relation to 2003. One of the activities in the programme is called 8-8-88 as it was started on national road no 8 which is currently the longest and most dangerous route in Poland. Next "8" in the definition is related to the decision that in 2008 next

8 national roads (no 1 – 9) was included. The last figure "88" says that there was still 88 national roads which need to be improved in next years and we managed to start the work on all of them. The programme collects infrastructural improvements like bypasses of villages and towns, better information of current state of traffic and road safety campaigns direction to specific hazardous areas. It is also to be mentioned the lastly prepared in scope of EU Euro RAP programme the map of international roads safety risk in Poland specifically dedicated to accidents with motorcycle (www.eurorap.pl).

This sort of items is however strongly related to private investors and local authorities (traffic control solutions) and still needs more careful attention of economy decision makers including UE support.

CONCLUSION AND FUTURE AIM

The overall road traffic safety in Poland seems to be waived during last 2-year period, based on statistical data given below. These changes does not mean good in comparison to our society needs. Taking into account the EU road safety policy goals to reduce by half the number of fatalities on European roads we are continuing the third stage (2007 – 2013) of national road safety programme called GAMBIT which is aimed at:

- vulnerable road users (pedestrians, bicyclists),
- people commonly ignoring traffic regulations, such as speed limits, drink-driving or not using restraint systems,
- traffic risk on major roads outside built-up areas (on the 6 % of the length of the road network, 25 % of all accidents, 40 % of all killed, 27 % of all injured, severity of accidents: 18 fatalities / 100 accidents),
- young drivers aged 18 – 24 (20 % of all involved in road accidents),
- intoxication of drivers and pedestrians.
- quicker exchange of the oldest part of vehicle stock

We hope that Polish participation in EEVC Working Groups, UN ECE, ESV, EU Commission and Council Working Groups together with ETSC and CITA activity will result in optimal use of our limited resources.

I would like to wish all of you a good co-operation and fruitful exchange of knowledge during this very important scientific international ESV conference being one of the important bases for improvement of everyday life – improvement of vehicle safety and thus road traffic safety.

Table 1. Accident Data in Comparison with the Vehicle Stock and Population in Poland in the Period 2001-2010

Year	No. of accidents	No. of fatalities	No. of injured	No. of vehicles (thousands)	No. of passenger cars (thousands)	Population (thousands)	Fatality factor (No. of fatalitie/1mln of inhabitants	Accident severity factor (No.of fatalities/100 of accidents)	No. Of passenger cars/1000 inhabitants
2001	53 799	5 534	68 194	14 724	10 503	38 632	143	10	272
2002	53 559	5 827	67 498	15 525	11 029	38 219	152	11	289
2003	51 078	5 640	63 900	15 890	11 244	38 191	148	11	303
2004	51 069	5 712	64 661	16 701	11 975	38 174	150	11	314
2005	48 100	5 444	61 191	16 816	12 339	38 157	143	11	323
2006	46 876	5 243	59 123	18 035	13 384	38 126	138	11	351
2007	49 536	5 583	63 224	19 472	14 589	38 116	146	11	383
2008	49 054	5 437	62 097	21 337	16 079	38 136	143	11	422
2009	44 196	4 572	56 046	22 025	16 495	38 167	120	10	432
2010	**38 832**	**3 907**	**48 952**	**22 686***	**16 990***	**38 187****	**102**	**10**	445

* Estimated by Motor Transport Institute
** Central Statistical Office as of June 30, 2010

STATUS REPORT OF REPUBLIC OF KOREA

Ministry of Land, Transport and Maritime Affairs
Korea

Jongsoo KIM
Sr. Researcher
Division of Advanced Safety Vehicle
Korea Automotive Testing and Research Institute
Korea

INTORDUCTION

The decrease in fatality became slow since 2004 as shown in Figure. 1. This trend led the government to establish the comprehensive accidents reduction policy of 'Reduce traffic fatalities by half' with the collaboration of six Ministries in 2008. The main goals of the traffic safety policy are to achieve an average level of traffic safety indices among OECD member countries by 2011 and to reduce fatalities to 3,000 by 2012. The policy included measures regarding the pedestrian protection, drunken driving, school zone improvement, commercial operators and public promotion.

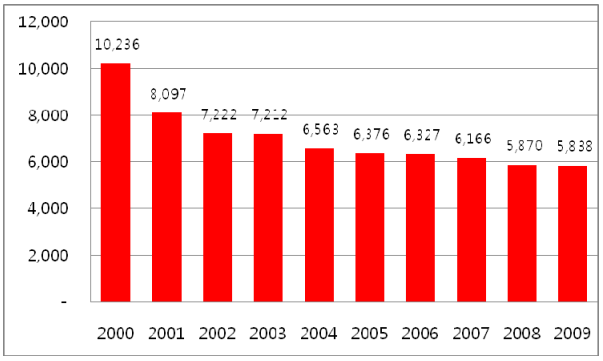


Figure 1. Fatalities Statistics since 2000.

TRAFFIC ACCIDENTS ANALYIS

While the total fatalities and injuries decreased slowly in recent years, the fatalities per 100,000 people and 10,000 vehicles improved from 21.8 and 7.4 to 12.0 and 2.8 between 2000 and 2009. The total number of accidents relatively remains unchanged around 220,000. The characteristics of traffic accidents in 2007 were analyzed to find out where the improvement could be made to further reduce casualties and injuries. By collision type, vehicle-to-vehicle collisions accounted for 75% of accidents, while vehicle-to-pedestrian collisions for 21%. In terms of fatalities, pedestrian fatalities accounted for 36%, while fatalities in vehicle-to-vehicle accidents for 41.4%. The government needs to address the protection of vulnerable pedestrians.

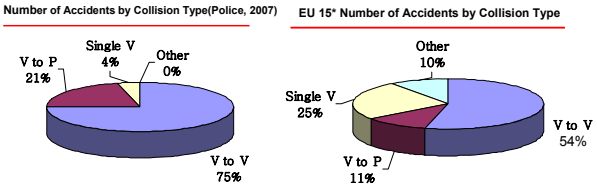


Figure 2. Accidents by collision type (2007).

Among fatalities of vehicle-to-vehicle accidents, side impacts represented 40.7% of fatalities. According to the statistics of EU 15 countries, vehicle-to-vehicle collisions accounted for 54% of accidents, while fatalities due to these collisions accounted for 50%.

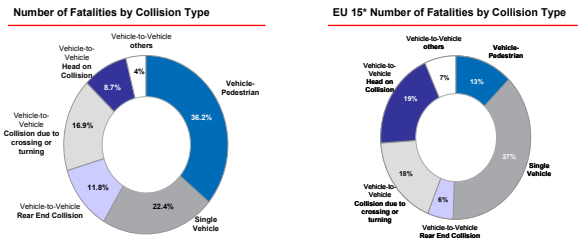


Figure 3. Fatalities by collision type (2007).

The recent trend to be noted was the increase in new SUV sales in the past several years due to the artificially created price difference between gasoline and diesel. The new SUV sales jumped from 8% in

late 1990 to 68% in mid 2000. This trend will raise compatibility issues later on. Another issue to be addressed is an emergency rescue system. According to the 2006 fatalities statistics 1,488 victims died at scene and 2,443 victims died under treatment.

ADVANCED SAFETY VEHICLE RESEARCH & DEVELOPMENT PROJECT

Overview

In the past decade new advanced safety technologies incorporated with information have been emerged and proliferated in the motor vehicles. These new technologies may be assessed with new safety concepts apart from conventional safety concepts. As new advanced features drew attention, the public demand these features to reduce and prevent traffic accidents. A study on the establishment of roadmap of advanced safety vehicle project was completed mid 2009. The advanced safety vehicle project was launched late 2009. It spans almost 8 years and its budget is about 18 million dollars from government grant with 6 million dollars matching fund from industries. Eleven organizations, comprising research institutes, academia and industries, are participating in the project.

The goal of the project is to develop advanced safety vehicle technologies and their assessment procedures. A regulatory system will be established based on the assessment procedures. The project has three main fields; mitigation of casualties, improvement of active safety technology and safety integrated with information technology.

Roadmap

The project has been being carried out in three stages.

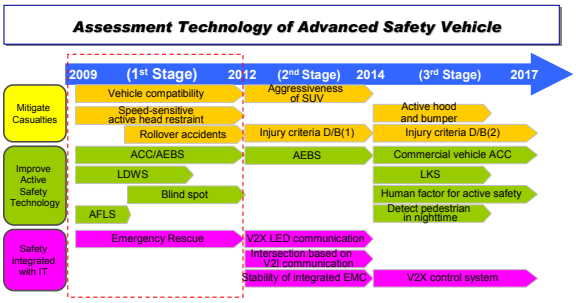


Figure 4. Project roadmap

Research Fields

Mitigate Casualties

- Vehicle Compatibility
- Speed-sensitive Active Head Restraint
- Active Hood and Bumper
- Rollover Accidents

Improve Active Safety Technology

- Adaptive Cruise Control
- Automatic Emergency Braking System
- Lane Departure Warning System
- Lane Keeping System
- Blind Spot Detection System
- Adaptive Front Lighting System
- Night Vision

Safety Integrated with IT

- Emergency Rescue System
- V2X Communication
- V2X Control System

HYDROGEN FUEL-CELL VEHICLE SAFETY

The Hydrogen Fuel-Cell Vehicle Safety project was initiated in December 2007. The project will be completed in June 2012. The budget is about 12 million dollars from government grant with 12 million dollars matching fund from industries. The number of participating organizations is 7. The participating organizations form four groups which specialize in four area; policy and system, hydrogen safety, in-use vehicle safety, electrical safety. The goal of the project is to secure the safety of hydrogen fuel-cell vehicles, especially high pressure hydrogen safety and electrical safety.

ELDERLY PEOPLE-FRIENDLY VEHICLE PROJECT

The elderly people-friendly vehicle project was initiated in October 2006. The project will be completed in June 2011. The budget was about 6 million dollars from government grant with 8 million dollars matching fund from industries. The number of participating organizations is 9. The project was carried out from three view points; comfort in egress and ingress, safety in airbag and safety-belt, night vision. The concept of an elderly people-friendly vehicle is that anything safe for the elderly is safe for any age. At the end of the project a demonstration vehicle for the elderly will be built. The recommendations, rather than regulatory approach, will be issued to build elderly people-friendly vehicles. Senior passengers in elderly people-friendly vehicles

are likely to be injured less severely than those in ordinary vehicles under the similar accident condition. Elderly people-friendly vehicles are expected to cost a little bit higher than ordinary vehicles. An incentive, from government side and insurance company side, will be considered to promote elderly people-friendly vehicles.

VEHICLE TECHNICAL REGULATIONS

New technologies and advanced safety features with proven record of accidents prevention would be incorporated. Also measures will be implemented to disseminate those technologies in 2012 as much as possible. To reduce commercial vehicle accidents the scope of commercial vehicles subject to speed limiter will be expanded. . The mandatory installation of brake assist system will be considered in 2011 to assist weak drivers. The electronic stability control system GTR will become mandatory to new passenger vehicles from 2012 and to all passenger vehicles in 2015.

The pedestrian protection GTR will be enforced on new passenger vehicles from 2013 and on all vehicles with GVW of 4.5 ton or less in 2018. To promote the pedestrian protection GTR as early as possible the assessment of pedestrian protection was introduced three years ago. Since the introduction, manufactures have successfully responded to this new regulation. To reduce accidents caused by commercial vehicles, an advanced emergency braking system for large commercial vehicles will be considered in 2011. Once AEBS is introduced, the scope will be gradually expanded.

COMPRESSED NATURAL GAS BUS

In the past high-pressure vessels used in vehicles were managed by the Ministry of Industry. A CNG bus accident in the middle of city drew adverse publicity last year. This led the government to restructure the management of high-pressure vessels used in vehicles. The Ministry of Land, Transport and Maritime Affairs will take responsibility for high-pressure vessels used in vehicles. A periodic inspection system will be introduced.

SELF-CERTIFICATION SYSTEM

Recall Notification System

The recall notification is essential under the recall system. However, owners of recalled vehicles often do not receive the notification. The recall response rates remain about 80% in the past several years. A new notification system will be introduced in addition to the current system this year. Owners will be notified if their vehicles subject to recall when they bring their vehicles for periodic inspection to inspection stations.

KNCAP

In The Korean NCAP has been introduced in 1999 and has evolved ever since. KNCAP was implemented with one assessment item, and now the number of items is eight, including pedestrian protection. Seven items are assessed by the law, and one item, a pole side impact, is assessed upon manufacturers' requests.

- full barrier frontal collision
- offset deformable barrier collision
- lateral collision
- seat (head restraint)
- pedestrian protection
- rollover propensity
- braking
- pole side impact

A study on the new comprehensive rating system is well under way and will be completed at the end of this year. Upon the completion of the study relevant regulations will be amended in 2012 and implemented in 2013. Vehicles with advanced safety features will be assessed in favor over vehicles without those features (such as a lane departure warning system, automatic emergency braking system) in the new comprehensive rating system.

A new approach to upgrade the KNACP will be tried by putting a 5%tile female dummy in the passenger seat this year. An advanced European moving deformable barrier will be tested also. The labeling guideline was published last year. To further promote the KNCAP to the public the mandatory labeling law will be considered in 2013.

INTRNATIONAL ACTIVITIS

Rechargeable Energy Storage System

At the near completion of an electrical safety regulation for electrical vehicles and hydrogen fuel-cell vehicles, a new informal group of rechargeable energy storage system was established under the auspice of WP29/GRSP/ELSA late 2010. In Korea the regulation for RESS has been implemented in 2009 after two-year research. Korea will actively participate in establishing regulations for RESS with experiences accumulated in the past.

Pole Side Impact

Real world side impact accidents data will be analyzed. Those characteristics will be compared with those of side impact tests. The results will be fed into the development of PSI GTR.

World Side Impact Dummy

Korea will participate in the round robin test of world side impact dummy. The repeatability and reproducibility of WorldSID will be presented. In addition a finite element model will be developed and validated.

GOVERNMENT STATUS REPORT, SWEDEN

Anders Lie
Claes Tingvall
Swedish Transport Administration
Sweden

SWEDISH ROAD SAFETY ORGANISATION

The Ministry of Enterprise, Energy and Communications is responsible for road traffic safety in Sweden. The ministry is limited in size and the Swedish Transport Administration handles much of the practical and operational work. The administration is responsible for the planning, building and operation of roads and railroads. The Swedish Transport Administration also has the overarching role to develop long term plans for all modes of transport. The Transport Administration holds responsibility for research within the fields of mobility, environment and traffic safety. It is also performing in depth studies of fatal crashes within the road traffic system. When co-operation with other actors in society is necessary to effectively achieve its goals the Administration may work together with these actors.

From 2009 the Swedish Transport Agency has overall responsibility for regulations within air, sea, rail road and road traffic. Within the Swedish Transport Agency the Road Traffic Department formulates regulations, examines and grants permits, as well as exercising supervision within the field of road transport over e.g. road traffic, vehicles, driving licences and commercial transport. The agency also conducts analyses of road traffic and supply information about injuries and accidents within the road transport system. Swedish Transport Agency is also holding vehicle and driver licence registers.

The Swedish Transport Administration and the Swedish Transport Agency are both responsible to work towards the transport policy goals set up by the parliament.

In Sweden the main other bodies active in road traffic safety efforts are the police and the local authorities. Other important parties are the National Society for Road Safety (NTF), with its member organisations, and transport industry organisations. The Group for National Road Safety Co-operation (GNS) is a central body that co-ordinates co-operation between the Swedish Transport Administration and Agency, the local authorities the authority for occupational health and safety and the police. The NTF is an additional member of this group, as well as some partners from the private sector.

The Ministry of Enterprise, Energy and Communications sets the agenda for traffic safety operation. Important initiatives from the Swedish government in the field of traffic safety the latest years are among others:

- A new system for speed limits, building on the "Safe System" approach
- A mandatory risk education for everyone taking a drivers licence
- Improved regulation for safer moped driving
- Stringent safety and environmental demands on cars used by the government and the authorities
- The introduction of a permanent alco-lock program.

FATALITIES

The Swedish overall long-term safety objective within the road transport system was settled in 1997, when the Swedish parliament voted for the "Vision Zero". This vision states that ultimately no one should be killed or seriously injured in the road transport system. The design and function of the system should be adapted to the conditions required to meet this goal.

Sweden has a long tradition in setting quantitative road traffic safety targets. The recent target was set in 2009 by the government. This target is set at a 50% reduction of fatalities between 2007 and 2020 and a reduction of 25% of severe injuries during the same period. Sweden as member of the European Union was part of the union's target of a 50% reduction of fatalities between 2001 and 2010. For Sweden that target meant a maximum 271 fatalities year 2010.

In the year 2010 the number of fatalities in Sweden was 287 (preliminary estimate). This number includes suicides. The suicides have historically been included in the Swedish statistic. From 2010 these will be reported separately and excluded from the general statistics of road traffic fatalities. This is in line with international practice (United Nations et al. 2009). The road toll in Sweden then is reduced by 20 suicides to 267 thus reaching the 50% EU target for 2010.

With around 270 fatalities per year Sweden is one of the safest countries when it comes to road traffic, with a level of 2.8 fatalities per 100.000 inhabitants. This is less than half of the European Union risk average (6.9 fatalities per 100 000inhabitants year 2009).

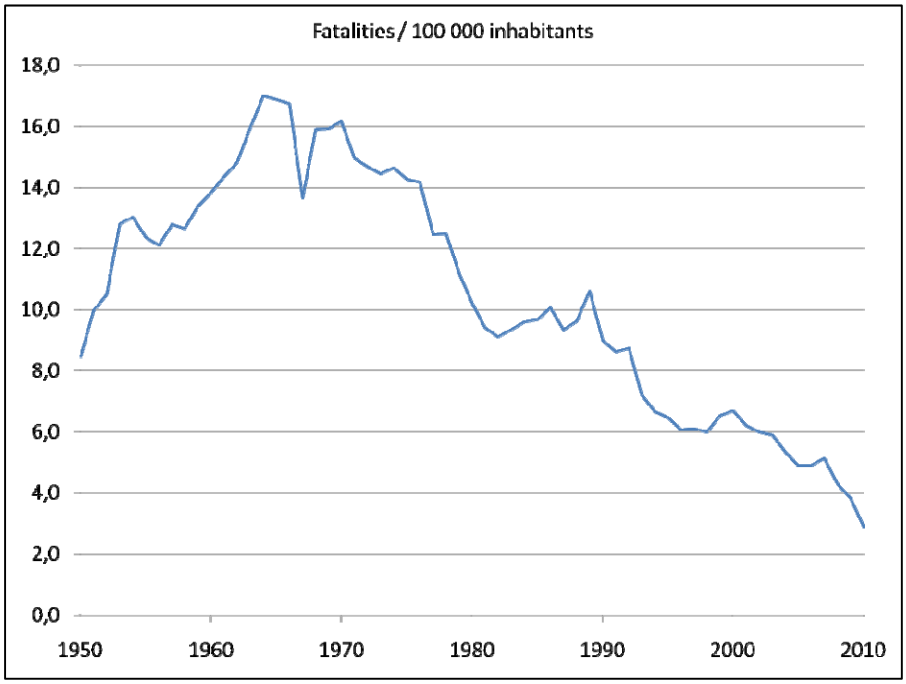


Figure 1. Road fatalities per 100 000 inhabitants in Sweden 1950-2010

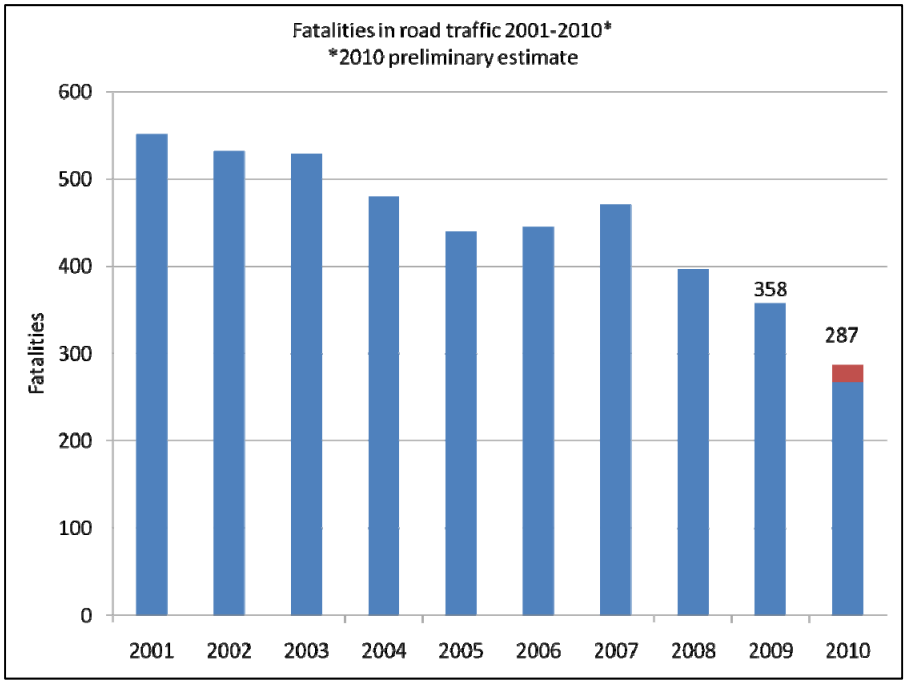


Figure 2. Road fatalities in Sweden 2000 to 2010

INTERIM TRAFFIC SAFETY TARGET FOR 2020

In 2009 the Swedish parliament stated a target of 50% reduction of fatalities and 25 % reduction of severe injuries from 2007 to 2020. This interim target towards the Vision Zero is a part of an updated continuing road safety operation in collaboration with other stakeholders. The previous interim target for 2007 was set without prior consultation with or commitments from parties and the target was not met until 2010.

The current Swedish road safety operation is based on a system of management by objectives where cooperation between stakeholders, targets on Safety Performance Indicators (SPI:s), and annual result conferences where road safety developments and targets are followed up. The aim is to create long-term and systematic road safety operation.

The road safety performance indicators that are monitored is speed compliance, sober driving, seat belt use, helmet use, safe vehicles, safe heavy vehicles, safe national roads, safe municipal streets, rested drivers, rapid rescue and valuation of road safety. These indicators each have a target for 2020 which makes prioritising between measures easier for stakeholders.

DEVELOPMENT TOWARDS THE GOAL 2020

Even though fatality figures in Sweden is at an all time low the status for the SPI:s shows that there are still a lot of work to be done in order to make the reduction sustainable over time.

One of the most challenging indicator targets are the one for speed compliance, were the percentage of traffic driving within speed limits has to increase from around 50 % in 2004 to 80 % by 2020. Reduced speeds have major safety potentials. So far the development has been good (due to a large introduction of speed cameras for example) but the gap between the current situation and the ultimate 2020 target is still vast. The development for seat belt use and bicycle helmet use has not been satisfactory so far. The development of the safe national roads has so far been most successful. This is due to a continued increase of roads with separation from head on collisions and a reduction of the speed limits from 90 km/h to 80 km/h on a large part of the roads with risk of head on collisions.

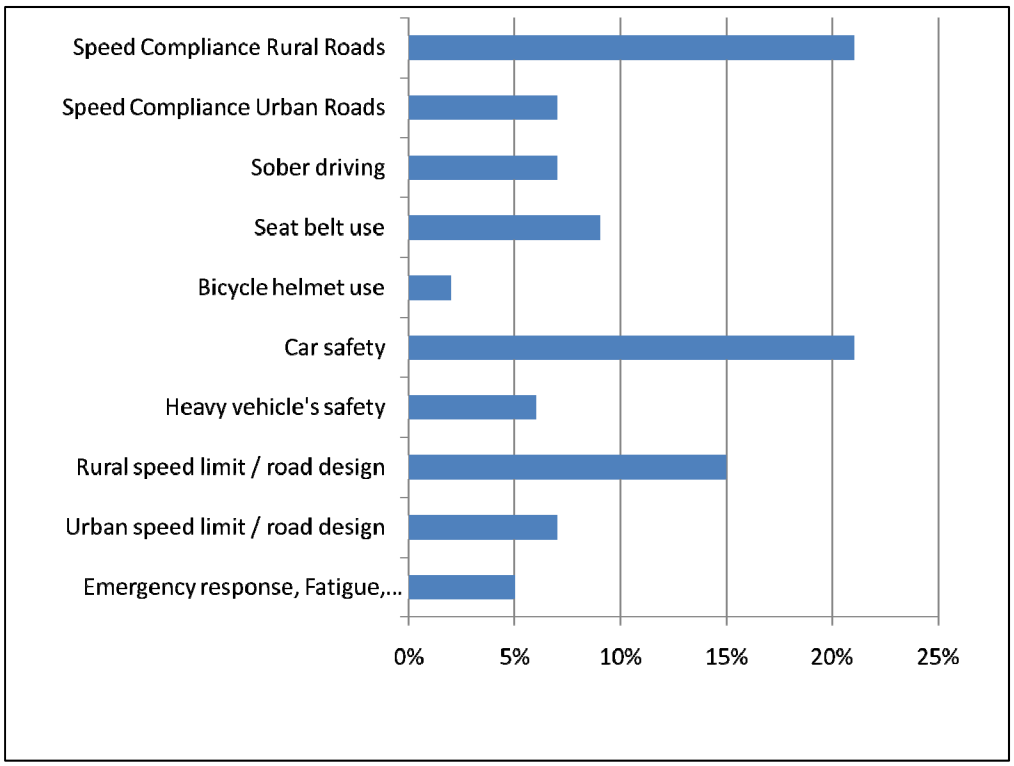


Figure 3. Calculated contribution to 2020 target from different focus areas

The role of the vehicles to contribute to the target is further discussed later in this paper. However, it is worth noticing that the replacement of the car fleet gave the biggest contribution to the results 2010.
The development towards the target is annually evaluated at a result conference in April. So far there have been two conferences making it possible for all stakeholders to meet and discuss further work towards the interim target and Vision Zero.
The indicator set-up and the targets are to be revised in 2012, making it possible to adjust targets level etc. to the current situation and to focus safety activities and investments.

ISO-MANAGEMENT SYSTEM FOR ROAD TRAFFIC SAFETY

In the spirit of the Tylösand Declaration, Sweden has been an initiator to get a new work within International Standards Organisation (ISO). The work is aiming at developing a Road-Traffic Safety Management System standard. (ISO/TC 241 - Project Committee: Road-Traffic Safety Management System). Sweden is through the Swedish Standards Institute (SIS) holding the secretariat.
The vision of the International Management Systems Standard is:
• Elimination of death and serious injury in the road transport system is the overarching goal.
• A voluntary and complimentary tool to legislation, addressing all organizations interacting with road traffic and driven by the needs of interested parties, including market forces.
• An approach to utilize and disseminate ”best practice”.
• Knowledge transfer from Traffic safety experts to the intended user community of the standard.
All requirements of the International Standard are generic and are intended to be applicable to all organizations regardless of type, size, products and services provided.
The project committee is planning to submit a draft international standard in the summer of 2011. The project has a timeframe up to 2012 to deliver and agree upon the proposed standard.

THE ROLE OF SAFER VEHICLES

The vehicles are of major importance when it comes to support the change of the road transport system. As can be seen above, the exchange and development of safer cars is an important pillar in the road safety work in Sweden.

It is becoming more and more evident that vehicle industry and road authorities must co-operate to define an interface where modern vehicle technology is given the right possibilities to work at its best. Strategies for speed signs are important for vehicle mounted cameras giving the driver information about the speed limit. Good and consistent lane markings are essential for modern lane departure assistance/warning systems. This need was confirmed by the European Council in their communication on traffic safety in December 2010. (European Commission 2010).
The Swedish Transport Administration has developed a co-operation with Volvo Cars to investigate areas of joint interest. The vehicle to road interface is one identified area. Another area of interest is setting boundary condition for safe speed. Some aspects of this co-operation are covered in a separate paper presented at ESV this year (Eugensson et al.).

PENETRATION OF SOME SAFETY SYSTEMS IN SWEDEN

Electronic Stability Control (ESC) has been proven to be very effective in reducing crashes related to loss of control (Erke, 2008, Ferguson, 2007, Lie et al. 2006).
The first studies of the effectiveness of ESC were published in the ESV conference 2003. Several studies followed in 2004 and 2005 establishing a scientific ground for declaring that ESC was effective.
The first mass market car with ESC was introduced late 1998. ESC was from then on gradually implemented on executive mid size and large cars and reached a 15 % new car sales penetration in mid 2003. Sweden has been world leading in getting a high degree of ESC penetration in new car sales. In December 2010, 99% of all new passenger cars were equipped with ESC. A special paper on this process was presented in the ESV-conference 2009 (Krafft et al. 2009).
Sweden has been part of Euro NCAP since the start of the organisation. Over the years since Euro NCAP started, the average scores have improved both for occupant protection as well as for pedestrian protection. Swedish Transport Administration has done an evaluation of the relation between Euro NCAP results and the risk of injury and fatality in real life crashes. The study shows a 70% fatality risk reduction between a Euro NCAP 2 star car and a 5 star car (Kullgren et al.

2010). At the ESV conference 2011 a Swedish study will be presented showing the relation between Euro NCAP pedestrian score and real life impairment risks (Strandroth et al. 2011). An approximate 20% reduction of injuries causing permanent medical impairment is estimated for two star pedestrian protection compared to one star cars. The injury reduction grows with higher levels of medical impairment and in lower impact speeds.
In December 2010 almost 95% of the new car sales had a seat belt reminder according to Euro NCAP specification for the driver. 75% had a reminder for the passenger and 35% a system to monitor seat belt use in the rear seat. Seat belt reminders are reducing the number of unbelted driver in city traffic with 80% in Europe (Lie et al. 2008). A Swedish study has shown that between 2005 and mid 2009 no one has died unbelted in a car with a seat belt reminder living up to Euro NCAP's specification (Swedish Transport Administration 2010). This is very promising.

THE CONTRIBUTION OF NEW VEHICLES

With a rapid development of vehicles safety there has been of interest to calculate the yearly benefit of the exchange of the vehicle fleet. With about 230 fatalities in cars every year, the exchange of slightly fewer than 7% results in around 8 "saved" lives in 2010. Out of these about two thirds comes from the better crash protection and one third from the ESC systems.

ABS ON MOTORCYCLES

The Swedish Transport Administration has done a study on the effectiveness of ABS on motorcycles (Rizzi et al, 2009). The study set out to evaluate the effectiveness of antilock brake system (ABS) technology on motorcycles in reducing real life injury crashes and to mitigate injury severity. The study comprised an analysis of in-depth fatal crash data in Sweden during 2005–2008 to investigate the potential of ABS as well an estimate of the effectiveness of ABS in crash reduction in Sweden between 2003 and 2008 using induced exposure methods.
Induced exposure analysis showed that the overall effectiveness of ABS was 38 percent on all crashes with injuries and 48 percent on all severe and fatal crashes, with a minimum effectiveness of 11 and 17 percent, respectively. The study recommends the fitment of ABS on all new motorcycles as soon as possible and that customers only should purchase motorcycles with ABS.
Since the launch of the result in June 2009 importers has taken initiative to increase the number of motorcycle models with ABS as standard and the share of new motorcycles with ABS has gone from 15% in 2009 to 60% in 2010. One insurance company has also decided to reduce the insurance costs with 15% for motorcycles with ABS.

FFI – STRATEGIC VEHICLE RESEARCH AND INNOVATION

Transport, mobility and accessibility are of major importance for quality of life and growth. If society is to continue its positive development, transport solutions must be safe and environmentally sustainable. Safe electric cars, smarter logistics and resource-efficient production technology are examples of the innovation and renewal which can help the Swedish automotive industry meet this challenge. To drive the development forwards, Sweden's government and industry are investing in a long-term partnership within FFI – Strategic Vehicle Research and Innovation.
FFI funds R&D that focuses on climate, environment and safety. The effort is ongoing and includes some €100 million per year, half of which comes from public funds through VINNOVA, the Swedish Transport Administration and the Swedish Energy Agency. An equivalent amount is invested by the five industrial partners: Volvo, FKG (Scandinavian Automotive Suppliers), Saab Automobile, Scania and Volvo Cars. This collaboration between public bodies, industry, educational establishments and research institutes is intended to provide high-quality results and contribute to positive social development.
FFI funds projects with two thirds of the money going to climate and environment and one third to safety. An FFI board is responsible for setting a balance between targeted projects and more long-term efforts which can deliver groundbreaking results. The board's duties also include promoting constructive cooperation between the various actors in the road traffic system.
The investments in FFI take place through various collaborative programmes. One is vehicle and traffic safety. Sweden is a world leader in traffic safety. The programme will contribute to the continued development of vehicles with active systems to prevent accidents as well as passive ones

to mitigate the consequences of those accidents which nevertheless occur. Initiatives have a systemic approach so as to get roads, vehicles and road- users to interact well.

IMPORTANT FIELDS FOR FURTHER RESEARCH

Many fatalities in Sweden as well as globally is related to impaired driving. In Sweden 2009 21% of killed vehicle drivers had illegal levels of alcohol on their bodies (Trafikanalys 2010). As many other countries Sweden has an alcolock programme for repeated offenders. There is also some 70 000 alcolocks used in Sweden in trucks, buses and taxis on a voluntary basis. These alcolocks are used on an emerging market for safe transports. Both buyers of transports and suppliers have found these locks attractive to ensure sober drivers. However there is a significant need for further technological development of reliable and non-intrusive alcolock system.

Alcohol consumption is not the only reason for impaired driving. Often fatigue, distraction, legal and illegal drugs as well as alcohol are lumped into the term impaired drivin. Vehicle systems are out on the market that detect distraction and fatigue. These systems are using signals from the vehicle to analyze the state and driving patter for the driver. Already today the cars have an idea about when driving isn't up to standards. The systems as of today have weak feed back to the driver and uses signal lamps of haptic feed back. Not far away in time the vehicle will have a good estimate of the potential impairment of the driver. The question is how a vehicle, on its own, can restrict and guide the driver into a safe driving envelope. The most evident way is to limit the speed of the vehicle and putting safety systems into a more nervous mode. This makes a potential crash avoided and less harmful. There is an evident need in society to research this field and to develop guide lines for a safe shut down sequence.

The layout of infrastructure and the properties of it are becoming important for modern safety technologies. Already today lane departure warning systems are using lane markings as a critical component. In the near future crash avoidance by steering will need even better environmental awareness from lines and other road furniture. More and more cars are reading traffic signs and speed restriction signs are used to help drivers from speeding. As indentified by the European Council, there is an urgent need for better co-operation between vehicle manufacturers and suppliers, and road authorities. Rules, standards and strategies for line painting and road signs could be aligned with the properties of modern vehicle systems to better achieve good functionality and safety.

Speed management is a key element to achieve good safety. More and more countries are using speed cameras and section control to diminish illegal speeding. In Sweden more than 1000 speed cameras have been put up the last years. This has generated an emerging market demand for support systems helping users not to speed. Already many years ago nomadic SATNAVs indicated the speed limit. The same approach is now entering integrated navigations systems. Some vehicle manufacturers are also using cameras to read speed signs. As an effect of the marker development the consumer crash test program Euro NCAP has decided to develop a protocol to assess Intelligent Speed Assistance systems (ISA). When the protocol is ready consumers will be able to get independent consumer information on key properties of ISA-systems. A better compliance with speed limits will give significant environmental benefits through lower fuels consumption.

Reducing energy in a crash is one of the most powerful ways to minimize injuries to road users (Krafft et al. 2009). At ESV 2009 two examples were shown, the Mercedes Benz Braking Bag (Danielson 2009) and the "Brake Stopping Distance Shortening System with Sticky Liquid" presented in the students competition by The University of Tokyo. These studies show that new technologies and approaches can be developed for brake with more than 1 g. The use of air brakes, down force from aerodynamic properties, track bite or other approaches could give significant benefits for better braking and steering in emergency situations. Better braking and steering makes a later decision on intervention possible and is giving more reliable actions.

Just like vehicle safety and road safety have been two to a large degree separate cultures, vehicle safety and ITS (intelligent Transport System) have been driven by different groups in industry and society. There are high expectations from the ITS side to solve traffic safety problems. Further research is needed in which vehicle safety experts and ITS experts more clearly defines the areas of potential for improved safety. This should be done for the different stages of a driving process leading up to a potential crash. The connected vehicle is

probably more important to strategic decisions in the driving than for support in emergency situations. A reasonable balance must be achieved between safety from connectivity, active and passive safety. This balance should be further investigated and communicated.

CONCLUSIONS

When it comes to traffic Sweden is one of the safest countries in the world. The Vision Zero approach has further boosted a good safety culture.
The exchange of vehicles in combination with improved vehicle technology is a major contributor to achieve ambitious traffic safety targets. As more than 50% of new sales cars are sold to companies and other non private buyers, active strategies to convince large fleet buyers to choose best safety standard is of outmost importance.
Road users have a responsibility to operate within the safety limits of the road transport system. Vehicle technology can support this. Intelligent seat belt reminders, systems alerting drivers when speeding and alcohol starter interlocks are important systems to further develop and put on the market in large scale.
The ISO 39001 management system standard for traffic safety will give organisations a possibility to work focused with traffic safety.
Vehicle manufacturers and organisations responsible for infrastructure must develop better co-operations to ensure that the modern road offers a useful interface to modern vehicle technology such as lane departure warning and traffic sign recognition.
A safe system is achieved when user capabilities, vehicle safety, road design and speed limits all are in harmony. A holistic perspective on road safety is under development and is important when prioritizing research efforts.

More general information is available at the following pages
http://www.trafikverket.se/eng
http://www.transportstyrelsen.se/en
http://www.vinnova.se/en/ffi/

REFERENCES

Danielson, C. (2009). The Mercedes-Benz ESF 2009 Experimental Safety Vehicle: General overview. Accessed from: http://www.emercedesbenz.com/Jun09/10_001666_The_Mercedes_Benz_ESF_2009_Experimental_Safety_Vehicle_General_Overview.htm

Eugensson A, Ivarsson J, Lie A, Tingvall C. Cars are driven on roads, joint visions and modern technologies stress the need for co-operation. Paper Number 11-0000. Proc 22th ESV Conf. Washington 2011

European Council's conclusion on "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: "Towards a European road safety area: policy orientations on road safety 2011-2020". Accessed at: http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/trans/118150.pdf

Krafft M, Kullgren A, Lie A, Strandroth J and Tingvall C. The effects of automatic emergency braking on fatal and serious injuries. Paper Number 09-0419. Proc 21th ESV Conf. Stuttgart 2009

Krafft M, Kullgren A, Lie A, Tingvall C. From 15% to 90% ESC penetration in new cars in 48 months - The Swedish experience. Paper No. 09-0421. Proc 21th ESV Conf. Stuttgart 2009

Kullgren A, Lie A, Tingvall C Comparison between Euro NCAP Test Results and Real-World Crash Data. 2010 Traffic Injury Prevention, 11: 6, 587 — 593

Lie A, Tingvall C, Krafft M, Kullgren A. The Effectiveness of Electronic Stability Control (ESC) in Reducing Real Life Crashes and Injuries. Traffic Injury Prevention, Vol. 7:1 pp38-43 2006.

Lie A, Kullgren A, Krafft M, Tingvall C. Intelligent Seatbelt Reminders. Do They Change Driver Seat Belt Use In Europe. Paper No. 07-0388. Proc 20th ESV Conf. Lyon 2007 Also revised in Traffic Injury Prevention, 9:446–449, 2008

Rizzi, M., Strandroth, J. and Tingvall, C. 2009. "The Effectiveness of Antilock Brake Systems on Motorcycles in Reducing Real-Life Crashes and Injuries". Traffic Injury Prevention,10:5, 479-487.

Strandroth J, Rizzi M, Sternlund S, Lie A, Tingvall C. The correlation between pedestrian injury severity in real life crashes and Euro NCAP pedestrian test results. Paper Number 11-0188. Proc. 22nd ESV Conf. Washington DC, 2011

Swedish Transport Administration. Bilbältesanvändning i dödsolyckor (Seat belt use in fatal crashes), En analys av vägtrafikolyckor i Sverige 2005-01-01 till 2009-06-30, Swedish Transport Administration. Borlänge 2010. Accessed at http://publikationswebbutik.vv.se/upload/5851/2010_070_baltesanvandning_i_dodsolyckor.pdf

Tingvall C, Stigson H, Eriksson L, Johansson R, Krafft M, Lie A. The properties of Safety Performance Indicators in target setting, projections and safety design of the road transport system. Accident Analysis and Prevention. Vol. 2010, No. 42, pp. 372-376, 2010.

Trafikanalys. Vägtrafikskador 2009. Stockholm 2010. Accessed 2011-02-22 at http://www.trafa.se/document/Vägtrafikskador%202009.pdf

United nations economic commission for Europe, International transport forum and Eurostat. Illustrated glossary for transport statistics. Geneva 2009

UNITED STATES GOVERNMENT STATUS REPORT

John Maddox
National Highway Traffic Safety Administration
United States

State of Motor Vehicle Safety

In 2009, 33,808 fatalities occurred in the U.S. as a result of motor vehicle crashes. This is the lowest number of deaths since 1950. The number of motor vehicle-related fatalities in 2009 fell 9.7 percent from the 37,423 fatalities in 2008.

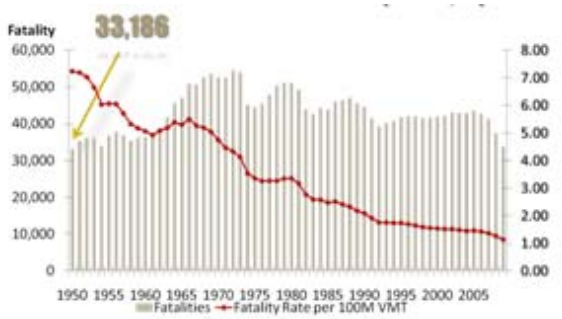


Figure 1. Fatalities and Fatality Rate per 100 Million Vehicle Miles Traveled Between 1950 and 2009.

Even more impressive, the fatality rate per 100 million Vehicle Miles Travelled (VMT) in 2009 fell to a historic low of 1.13 (see Figure 1). This downward trend is continuing, and a statistical projection of traffic fatalities in 2010 showed that an estimated 32,788 people died in motor vehicle traffic crashes

The total number of police-reported crashes in the U.S. in 2009 was estimated by the National Automotive Sampling System (NASS) General Estimates System (GES) to be 5.5 million, resulting in 2.22 million persons being injured. In recent years, the estimated number of injuries has decreased, as has the injury rate, based on VMT. In 2009, the injury rate fell to 74 people per 100 million VMT.

These improvements in motor vehicle safety are due in part to the collective efforts of the operating agencies of the Department of Transportation[1], the States, automobile manufacturers, and other private sector organizations. NHTSA's engineering efforts combined with its educational and enforcement programs that ensure proper compliance with the U.S. regulations have contributed to this significant achievement in safety.

Table 1 provides a breakdown of all motor vehicle fatalities by person type.

Table 1. 2008-2009 U.S. Fatalities by Person Type.

Motorists and Non-occupants Killed in Traffic Crashes				
Description	2008	2009	Change	% Change
Total*	37,423	33,808	-3,615	-9.7%
Motorists Killed in				
Passenger Vehicles	25,462	23,382	-2,080	-8.2%
Passenger Cars	14,646	13,095	-1,551	-11%
Light Trucks	10,816	10,287	-529	-4.9%
Large Trucks	682	503	-179	-26%
Motorcycles	5,312	4,462	-850	-16%
Non-occupants Killed				
Pedestrians	4,414	4,092	-322	-7.3%
Pedal Cyclists	718	630	-88	-12%
Other/Unknown	188	150	-38	---

Source: FARS 2008 [Final], 2009 Annual Report File [ARF]
* Total includes occupants of buses and other/unknown vehicles not shown in table

In spite of these hard-fought gains in vehicle safety, motor vehicle crashes continue to be a major public health concern. For example, motor vehicle crashes are the number one cause of death in ages 8 to 34, and among all age groups, are the third leading cause of fatalities (with cancer and heart disease as the #1 and #2 cause respectively).

For these reasons, NHTSA remains fully committed to its mission of working with industry and the public to improve motor vehicle safety through a coordinated effort involving research, education, enforcement, and rulemaking.

Status of Current NHTSA Research Programs

NHTSA research priorities are driven by problem size (as defined by crashes, injuries and fatalities attributable to specific vehicle or driver issues), by technical innovations that present new opportunities for improving safety, and by changing driver behavior and demographics. These technical, market and economic factors are used to develop three-year vehicle safety priority plans, and 5 year and longer term strategic plans. Aligned with DOT and NHTSA goals, Figure 2 illustrates the program development process among NHTSA data collection, research, rulemaking, and enforcement activities. Collectively, planning teams continuously strategize, prioritize and implement research programs, furthering the agency's

[1] The National Highway Traffic Safety Administration (NHTSA), the Federal Motor Carrier Safety Administration (FMCSA), the Federal Highway Administration (FHWA), Federal Transit Administration (FTA) the Federal Railroad Administration (FRA) and the Research and Innovative Technology Administration (RITA)

goals to reduce fatalities and injuries.

Figure 2. NHTSA Research Planning Process.

Strategic program plans and roadmaps are typically developed with outcomes aimed at regulatory decisions and implementations. Current plans and roadmaps include a Motorcoach Safety Plan, Connected Vehicles and Vehicle-to-Infrastructure Roadmap, Human Factors Roadmap, Distraction Plan, Biomechanics Plan, Alternative Energy Vehicle Safety Plan, Crashworthiness Plan, and Elderly Occupant Plan. Key programs are described in the sections that follow.

The Haddon Matrix is the most commonly used paradigm in the injury prevention field. Developed by William Haddon in 1970, the matrix provides a comparison of factors before, during and after an injury or death. By utilizing this framework, one can think about the relative importance of different factors, interventions, or programs. Figure 3 shows the NHTSA research program areas comprising an expanded Haddon matrix. A fundamental change to the Haddon matrix was adopted, whereby the pre-crash category is now composed of normal driving and crash imminent conditions. The expanded matrix better matches the breadth and scope of our crash avoidance and crash worthiness research programs.

Crashworthiness Research

Low Offset / Oblique Frontal

In June 2009, the National Highway Traffic Safety Administration (NHTSA) published a report that investigated the question "why, despite seat belt use, air bags, and the crashworthy structures of late-model vehicles, occupant fatalities continue to occur in frontal crashes (Rudd et al, 2009)." The report concluded that aside from a substantial proportion of these crashes that are just exceedingly severe, the primary cause was poor structural engagement between the vehicle and its collision partner: corner impacts, oblique crashes, impacts with narrow objects, and heavy vehicle underrides.

By contrast, few if any of these the 122 fatal crashes examined in the report were full-frontal or offset-frontal impacts with good structural engagement, unless the crashes were of extreme severity or the occupants were exceptionally vulnerable. As a result of the NHTSA study, the agency stated its intent to further analyze small overlap and oblique frontal crashes in its Vehicle Safety Rulemaking & Research Priority Plan 2009-2011 published in November 2009 and updated in April 2011 for 2011-2013 (NHTSA, 2011a).

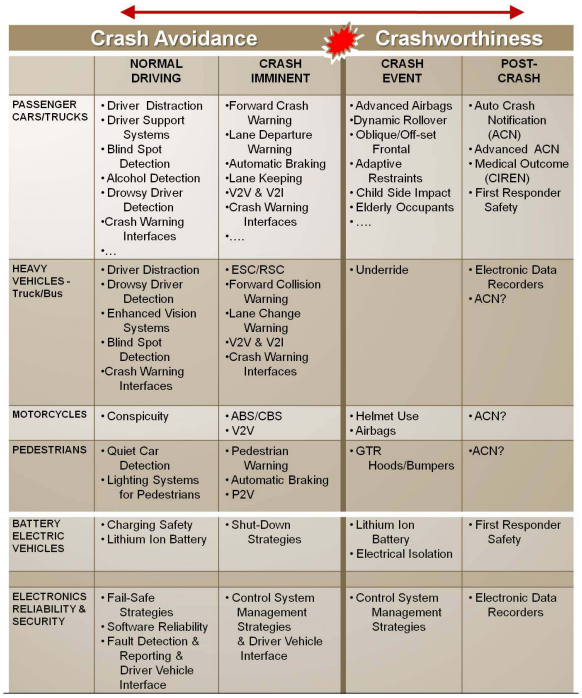


Figure 3. Expanded Haddon Matrix describes NHTSA Crash Avoidance and Crashworthiness programs.

NHTSA performed a detailed analysis of low offset/oblique non-fatal frontal cases taken from the National Automotive Sampling System (NASS) and the Crash Injury Research Engineering Network (CIREN). The real-world analysis of the crash data above and this study indicated that occupant kinematics is a concern because of the oblique nature of the impact. An interesting finding from the NASS/CIREN analysis showed a high rate of acetabular fractures sustained without have a concurrent femur fracture. Therefore, it was thought with the improved bio-fidelity and advanced instrumentation the THOR-NT crash dummywould better represent real-world occupant kinematics and injuries.

NHTSA has initiated a research program to investigate crash test protocols that replicate real-world injury potentials in low offset and oblique frontal crashes. NHTSA is investigating two test procedures for the low offset program. The first is a moving deformable barrier (MDB) into a stationary vehicle. In this procedure the outer edge of the MDB is expected to not engage the main longitudinal structure of the vehicle. A slight angle is added to the stationary vehicle to keep the MDB engaged during the impact. The second procedure is a vehicle at a slight angle being pulled into a pole. The test procedure that NHTSA is evaluating for oblique frontal crashes is an MDB into a stationary vehicle positioned at a certain angle. This angle is used to represent the obliqueness seen in the real world, and the overlap is such to engage one of the main longitudinal structures of the vehicle.

Heavy Truck Underride

In the 2009 study, rear underride occurred because the trailer underride guard was insufficient to prevent the underride. NHTSA is conducting a detailed analysis of all fatal underride crashes that occurred in 2008 (using the Trucks in Fatal Accidents, TIFA, database) to understand the scope of the problem. This study is collecting information on the design and safety performance of the truck underride guards.

In addition, in October 2010, the agency published the results of a study to determine the effectiveness of FMVSS No. 223/224 compliant underride guards at preventing fatalities and serious injuries in crashes where a passenger vehicle impacts the rear of a tractor-trailer (Allen, 2010). The main findings of the study suggest that while some states showed a decrease in fatalities and serious injuries in rear underride crashes, the decrease was not statistically significant due to small sample size. Further, the study was unable to establish a nationwide downward trend (since the introduction of the FMVSS No. 223/224 standards in 1998) in fatalities when a passenger vehicle rear-ends a tractor trailer.

Dynamic Rollover Protection

NHTSA is conducting a long-term project to evaluate the feasibility and development of a dynamic rollover test capable of evaluating occupant kinematics, injury mechanisms, and safety countermeasures during rollover crashes. This project is utilizing crash investigation, injury mechanism analysis, reconstruction, computer simulation, and a unique test environment to develop a more thorough understanding of occupant motion and injury patterns in rollover crashes. This work should facilitate future countermeasure development.

Child Passenger Safety

Using NHTSA's Fatality Analysis Reporting System (FARS) data files for the years 2003-2008, the agency estimated that 29 % of fatalities among 0-3 year old child passengers in motor vehicle crashes were in frontal crashes while 28 % were in side impact crashes. Side impacts are less common than frontal impacts yet they result in a comparable amount of fatalities. From NASS-CDS data files it was determined that 55% of AIS2+ injuries in 0-12 year old children were to the head and face, while 28% of AIS2+ injuries were to the torso.

NHTSA has been conducting research on the protection of children in side impact crashes. Much of that research has focused on developing a test procedure to evaluate CRS performance in side impact crashes. A side impact sled buck, based on a design by Takata, is currently being evaluated. Sled buck test parameters are currently being refined, based on crash tests and interior door component test results. The agency is also reviewing the current FMVSS No. 213 test procedure to determine the viability or advisability of increasing the simulated frontal impact speed from 30 mph to 35 mph and updating the existing test seat fixture.

In response to consumers' needs and state laws that require children to be in some form of child restraint until 6-8 years of age, child seat manufacturers have begun to increase the upper weight limits on many of their CRS models. In addition to higher weight usage limits, the CRS themselves tend to be heavier than the lower rated models. The agency is conducting research to assess the performance capability of the Lower Anchorages and Tethers for Children (LATCH) systems when used with these higher weight rated CRS models.

Children can strike side and other interior surfaces of the vehicle. Research efforts are underway to investigate the injuries from contact with lower door sections and vehicle interior components to see if there is need to increase the protection for rear occupants.

Lithium Ion Battery Safety

NHTSA's safety research program for electrically propelled vehicles will focus on lithium ion based rechargeable energy storage systems (RESS). These lithium ion RESS are anticipated to be used in most near term future applications of hybrid electric vehicles (HEV) and battery electric vehicles (BEV). NHTSA's approach is to develop performance criteria to analyze safety in RESS equipped vehicles in all operating conditions including battery charging, normal operation, and abnormal operation such as crash and post-crash

events. NHTSA's plan is to build upon experience from industry and the U.S. Department of Energy (DOT) by analyzing failure modes through a failure modes and effects analysis (FMEA), develop repeatable performance based test procedures and safety metrics to quantify the failure modes, and analyze the performance characteristics of an effective RESS control system.

Countermeasures for "Lightweighted" Vehicles

Future fuel economy requirements are expected to increase in stringency and require significant changes to vehicle design and possibly the distribution of vehicle types sold in the future. The crashworthiness of the new vehicle designs is anticipated to meet all major safety standards, but existing standards do not encompass the entire safety problem in the US fleet. The range of vehicle weights is expected to increase as lighter, more fuel efficient vehicles enter the fleet. The vehicle weight difference will translate directly into widely different crash severity for vehicle-to-vehicle crashes.

One challenge for lightweight fuel efficient vehicles is to enhance structural and restraint performance to accommodate a larger change in velocity and higher deceleration. Research is underway to evaluate the crash performance of potential lightweight vehicle designs. Finite element crash simulations are being used to study vehicle-to-vehicle crash safety performance. These simulations will be used to study potential safety countermeasures to maintain or improve the crash performance for future lightweighted vehicles.

Advanced Restraints

A recently completed study by the Crash Avoidance Metrics Partnership (CAMP) Advanced Restraints System (ARS) consortium demonstrated the ability of adapting restraints to occupant size, position, pre-crash information, and crash type. The ARS project assumed the occupant size and occupant position and deployed the restraints accordingly.

This next phase of this project also intends to utilize advanced restraints to adapt to varying occupant and crash pulse conditions. However, this project intends to develop an adaptive system (restraints, sensing technology, etc.) that will use real-time occupant and crash pulse sensing information to actively make decisions on how the restraint systems should function. Typical restraint system development, like that of CAMP-ARS, involves sled testing where the occupant (size, weight, position) and crash pulse (severity, direction of force) information is known in advance and restraint systems are remotely deployed based on this knowledge. The distinction of using "real-time" occupant and pulse data to "actively" deploy restraint systems in the current project is a unique and focal point of this effort.

Rear seat restraint designs have not kept pace with the advances that have occurred for front seating positions. NHTSA Research has included rear seat occupants in a series of full-scale frontal vehicle tests to evaluate the performance of the rear seat restraints. NHTSA is also studying the merits of advanced restraint systems, such as inflatable belts, load limiters, and pre-tensioners, for improving protection for adults in the rear seats as different technologies become available.

Motorcoach Research

NHTSA has been studying the issue of motorcoach occupant safety for several years. On average, motorcoach crashes cause 19 deaths annually. Ejection from the motorcoach is common to both frontal and rollover type crashes accounting for about half of all motorcoach passenger fatalities. Ejection is particularly harmful in fatal crashes, with rollover accounting for 75 percent of those fatalities. Installing seat belts would be the most direct method of retaining passengers within the motorcoach. The agency published a NPRM on this issue in 2010 (NHTSA, 2010a).

The agency is conducting research into ejection through window openings. Component tests using a guided impactor, are being carried out to evaluate the performance of various window glazing and latch designs.

Biomechanics Research

Biomechanics

NHTSA's Human Injury Research and Applied Biomechanics Divisions have led NHTSA's biomechanics research efforts over the past 35 years. The current research efforts are documented in the Biomechanics Research Plan, which will be available on the NHTSA Research website. This plan prioritizes the research activities based on the analysis of NHTSA's many crash databases including an in-depth analysis of crashes using the CIREN database. The research priorities, in part, were established on the basis of frequency, cost, and fatal outcome of the respective crash-related injuries.

Based on the analyses, the plan has developed a set of projects that will produce deliverables and results that can be used to support NHTSA's rulemaking initiatives (NHTSA, 2011a). Recent data analysis has indicated continued need to address the following areas: Child, Adult and Elderly Occupant Injury Mechanisms. This work will lead to injury assessment methods including advanced

Anthropomorphic Test Device (ATD) research and associated injury criteria.

Injury Mechanisms Research

Research continues to focus on injury outcomes / mechanisms and the development of new and improved devices (e.g. ATD's) to address the continuing issues observed in frontal, side, rear, and rollover crashes. For the adult occupant, head/brain and thoracic injuries continue to be necessary focus areas as supported by real-world crash data analysis.

These efforts include an analysis of mild traumatic brain injury and the criteria that may be used to assess it. Continued analysis of data using the SIMon (**S**imulated **I**njury **Mon**itor) model for the brain injury has supported the development of a BRain Injury Criteria (BRIC) that utilizes angular kinematics of the head derived from the to predict the probability of brain injury (Takhounts et al., 2011). Related research, including the analysis of football player head impacts and axonal strain related to diffuse axonal injury, will allow for further enhancements of the SIMon head model and for development of improved brain injury criteria.

Thoracic injury research continues as these injuries continue to be a major source of occupant harm in frontal, side and rollover crashes. Ongoing efforts in this area include the development of a standardized sled test that can be used to better define a more crash relevant thoracic response that can be used for future dummy development. Efforts are also looking to document the multi-point/multi-axis response of the thoracic to loading in support of advanced thoracic injury criteria. Finally, efforts are also focusing on the response of the thorax under oblique loading. These efforts may help to provide response requirements and injury criteria.

Anthropomorphic Test Device (ATD) Research

NHTSA's research efforts have focused on numerous updates and evaluations of adult ATDs. Included amongst these, are the short-term enhancements that have been implemented on the THOR, an advanced 50th percentile male frontal impact dummy (Figure 4). These short-term enhancements have been implemented to improve THOR response and usability and have been applied to an existing dummy, which is currently under evaluation. The results of these enhancements may encourage additional international use and acceptance of the THOR dummy. Similar to the 50th male, the 5th percentile female version of THOR will be subjected to a test protocol aimed to further assess its biofidelity and to identify requirements for any design enhancements that may be necessary in order to make the dummy suitable for use in standardized testing.

NHTSA has completed an assessment of WorldSID (50th percentile male) relative to biofidelity and crash test capability. The WorldSID 50th male shows improved biofidelity over existing side impact dummy designs and has performed well in current Agency side impact tests. Similar efforts are being done with the WorldSID 5th female to compare biofidelity versus existing ATDs.

A test series to determine biofidelity of rear impact dummies including the 50th percentile male BioRID dummy has been completed and analysis is in progress. The Human Injury and Applied Biomechanics Divisions will assess the test results to determine potential injury criteria and calibration and certification procedures for these dummies and continue to work with the international vehicle safety community to complete the analysis.

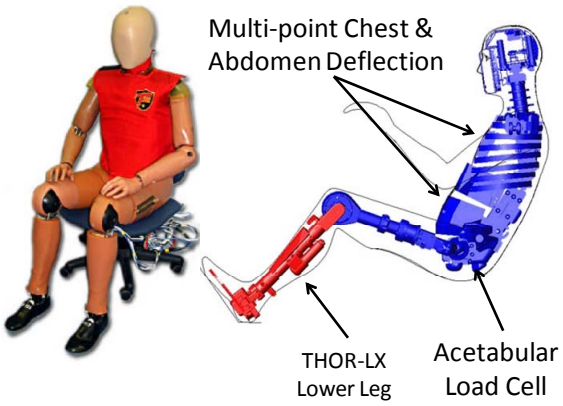


Figure 4. THOR 50th percentile male dummy.

Finally, NHTSA also has been completing efforts in support of child ATD development. First, NHTSA has supported the implementation of a revised neck, thorax and pelvis for the Q3s, 3-year-old side impact child dummy. The updated Q3s is currently undergoing evaluations for biofidelity, repeatability, reproducibility, and durability. Additionally, work continues to assess other child dummies such as the Hybrid III 6- and 10-year-old to include in future regulation as well as research to enhance the response of these dummies.

Vulnerable Occupant Injury Research

Vulnerable occupants include children, elderly occupants, and pregnant occupants. Dedicated field data analysis continues to help understand the issues and determine research efforts required. Recent CIREN and NASS-CDS data shows thoracic injuries are prevalent for older occupants. Research efforts to quantify the effects of changing thoracic geometry and material properties on the tolerance to thoracic loading as a person ages is in process (Figure 5).

Understanding the fragility (tolerance) and frailty (final outcome) for older occupants may help lead to design of tests and injury criteria that are more consistent with prediction of injury. This can lead to improved restraint design that may help to mitigate injuries in this rapidly expanding cohort of vehicle occupants.

With regard to children, NHTSA is leading a multi-center research effort to collect and document new child anthropometry, injury criteria and response data that together can be used in the development of advanced child dummies. Areas of study include the head, neck, shoulder, thorax, and abdomen. This effort will result in a set of un-scaled child dummy

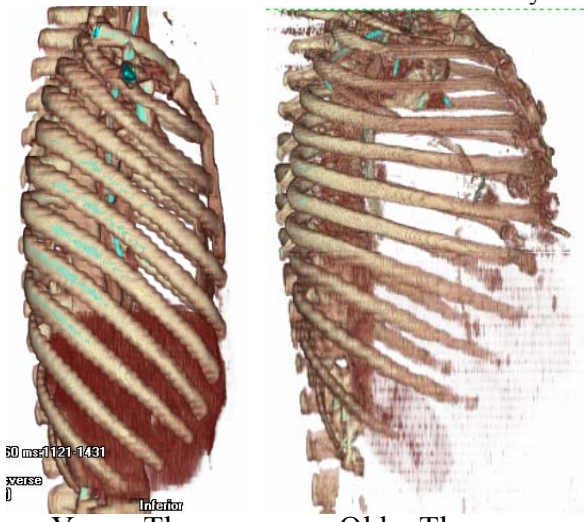


Figure 5. Images showing differences in geometry of a younger versus older thorax.

response requirements and injury tolerance data that can be used in support of advanced child dummy development.

Crash Injury Research and Engineering Network (CIREN) Developments

CIREN continues to explore new ways to enhance NHTSA's and the public's understanding of injury causation in crashes and refining the capability to define injury criteria. The Biomechanics Tab (Bio Tab) for analyzing and deducing injury mechanisms objectively is now in routine use and has been applied to specific injury producing events such as belted rollover occupants. This application has been aided by 3-Dimensional imaging techniques for injury identification as well as initial efforts to truly integrate the CIREN network through streaming Internet video of case reviews to all centers. This allows sharing of expertise and opinions on crash, vehicle and medical results to further enhance the data quality and richness. Also, efforts to link CIREN data with NASS-CDS may provide a powerful tool for future analysis of crash and injury data to create injury risk functions and ultimately, injury criteria. Finally, initial analysis of CIREN cases with information from Event Data Recorders (EDR) is being used to understand how crash information may be used to alert emergency response teams regarding injury severity so that better decisions can be made regarding transport of crash victims to appropriate centers of care.

Advanced Automatic Collision Notification (AACN)

In a collaborative effort between various NHTSA offices and the Centers for Disease Control (CDC), efforts are underway to study many considerations related to the implementation of AACN. It is expected that crash information transmitted from AACN systems to the appropriate response and medical personnel has the potential to significantly improve the outcomes of crash victims. The current NHTSA / CDC efforts are focused on documenting the effectiveness of current injury predicting algorithms and to make recommendations for future data elements and outcomes that should be used to predict the need for trauma center resources. Additionally, efforts are attempting to document the potential benefits of and considerations related to the integration of AACN data into emergency medical service (EMS) and trauma systems.

Crash Avoidance Research

Overview

NHTSA's crash avoidance mission seeks to advance the scientific knowledge of how to save lives, prevent injuries, and reduce economic costs by researching the effectiveness of various crash avoidance technologies. The program includes performing human factors/engineering studies to understand how such technologies can be best integrated into the driver-vehicle environment so as to aid the driver while minimizing distraction or other negative consequences. The results of this research are used by the Agency to improve highway safety through the regulatory process, consumer information activities and other means. This program relies heavily on problem sizes estimated from crash data that are collected, reduced, and maintained by the National Center for Statistics and Analysis (NCSA). The crash avoidance research program is implemented through a combination of contracts with research organizations, cooperative agreements with industry and university safety organizations, and internal testing and analysis.

A critical component of the crash avoidance research program is to understand the interaction of the driver,

the vehicle and the environment in pre-crash (normal driving and imminent), conditions. Figure 6 illustrates the vulnerable areas around a vehicle that can be addressed by crash avoidance technologies. The crash avoidance research program has three main focus areas: Advanced Technologies (light vehicle focus), Heavy Vehicles, and Human Factors as follows:

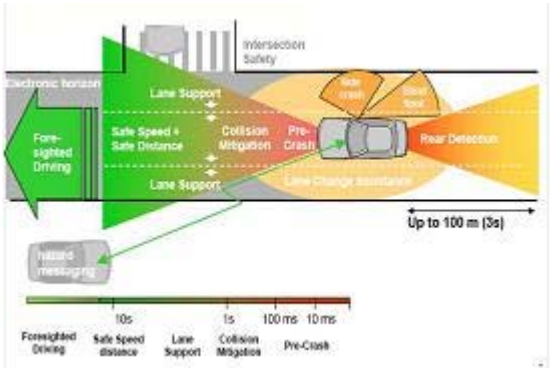


Figure 6. Vulnerable Areas Addressed by Crash Avoidance Technologies.

Advanced Vehicle Technologies

A key priority of NHTSA's light vehicle advanced technologies research program is intelligent vehicle technologies. This research is pursued as part of the Department's Intelligent Transportation Systems (ITS) Program. Research in the ITS area has focused on vehicle safety communications (VSC) and the integration of vehicle based safety systems (IVBSS).

Additional priority areas include: Developing new and improved methodologies to evaluate the safety impact of advanced crash avoidance technologies (ACAT); Electronics reliability and cybersecurity; and applied research to develop performance requirements and associated objective tests to support agency regulatory decisions.

Vehicle Safety Communications (VSC)

The U.S. Department of Transportation has conducted extensive research on the effectiveness of vehicle-based autonomous collision countermeasures for rear-end, road departure, and lane-change crashes. However, the systems have inherent limitations such as misidentification of stopped cars and out-of-path obstacles. VSC, paired with accurate vehicle positioning may overcome these shortcomings and improve safety system effectiveness by complementing or, in some instances, providing alternative approaches to autonomous safety equipment. NHTSA is exploring how both vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications can enable improved effectiveness of active safety systems.

NHTSA is conducting a collaborative research effort with a consortium of automobile manufacturers to facilitate the development and deployment of effective V2V communication safety systems. Figure 7 illustrates the V2V concept.

This project is developing safety applications, addressing interoperability issues and evaluating safety benefits.

Figure 7. Vehicle to Vehicle Communications.

In 2011, USDOT will initiate the Safety Pilot Program. Safety Pilot is intended to establish a real world model deployment test site for enabling wireless communications among vehicles. The Pilot uses rodside equipment to generate data, which will enable driver safety warning systems. The deployment site will encompass vehicles of various types that include a mix of integrated, retrofit, and aftermarket vehicle safety systems.

The goals of the Safety Pilot Program are to:

- Supplement benefits data in support of NHTSA 2013 Agency Decision on V2V Communications with Real World Field Data.
- Support real world V2V and V2I safety applications with a data rich environment.
- Create public awareness & determine user acceptance.

Anticipated outcomes include:

- Obtaining empirical data for estimating benefits and user acceptance in support of future federal policy actions.
- Establishing a public database of archived road network data for supporting development of additional safety, mobility, and environmental applications.
- Establishing multiple supplier sources for safety devices and roadside infrastructure.
- Develop a better understanding of the operational policy issues associated with the deployment of V2V and V2I applications

Integrated Vehicle Based Safety Systems (IVBSS)

About 3.6 million rear-end, road departure, or lane change crashes occur each year. Of these 3.6 million, 27,500 crashes result in one or more fatalities. These fatal crashes represent about ¾ of all fatal crashes.

The widespread deployment of advanced integrated driver assistance systems has the potential to reduce rear-end, road departure, and lane change collisions by 48 percent. Integrated systems can provide better hazard information from multiple sensors and provide coordinated warnings to reduce driver distraction. The IVBSS program is a four-year initiative that began in November 2005. This two phase cooperative research program was conducted by an industry team led by the University of Michigan, Transportation Research Institute (UMTRI).

Results from the Phase I Vehicle Verification Tests determined that the prototype system met its performance guidelines and was safe for use by ordinary drivers in a field operational test. The Phase II Field Operational Test started in January 2009. The light-vehicle and heavy-truck field operational tests examined the effect of a prototype integrated crash warning system on driver behavior and driver acceptance. Both platforms included three integrated crash-warning subsystems: forward crash; lateral drift; and lane-change/merge crash warnings. The light-vehicle platform also included curve-speed warning.

Integrated systems were introduced into two vehicle fleets: 16 light vehicles and 10 Class 8 tractors. The light vehicles were operated by 108 volunteer drivers for 6 weeks, and the heavy trucks were driven by 18 commercial-truck drivers for a 10-month period. Each vehicle was instrumented to capture detailed data on the driving environment, driver behavior, warning system activity, and vehicle kinematics. Data on driver acceptance was collected through post-drive surveys and debriefings.

Key findings indicated that use of the integrated crash warning system resulted in improvements in lane-keeping, fewer lane departures, and increased turn-signal use. Both the passenger car and commercial drivers accepted the integrated crash warning system and felt they benefited from improved awareness of vehicles around them. No negative behavioral-adaptation effects from using the integrated system were observed in either driver group.

Advanced Collision Avoidance Technologies (ACAT)

In September 2006, the ACAT program was established to identify new or emerging advanced technologies and to estimate the safety impact of these technologies. The ACAT program developed and applied a framework to understand the safety potential for vehicles that are equipped with emerging advanced safety technologies. This framework was used to estimate safety benefits.

Safety benefits assessment utilized a combination of national crash databases, data gathered from previous projects, data collected from objective testing, and data generated from computer simulations. Objective testing included test track testing and driving simulator testing.

In 2009, NHTSA completed four projects with teams led by automobile manufacturers, which focused on technologies that address frontal collision mitigation (primarily rear-end crashes), back-over prevention, and lane departure warning.

In June 2011, NHTSA will complete two remaining projects with teams led by automobile manufacturers, which focused on technologies that address head-on collision mitigation, lane departure prevention, and blind spot detection.

Electronic Control Systems

Electronic control systems in vehicles raise concerns for driver safety related to system reliability, cyber security, and driver-vehicle interfaces. Crash avoidance program are addressing strategies for fail safe operation, diagnostics, software reliability, hardware validation, and electromagnetic compatibility. Cyber security challenges address on-board tamper-proofing, hacking and malicious external control. Driver-vehicle interaction challenges address concerns about the transition of control between vehicle and driver arising from advances in V2V and V2I sensing, and driver responses to control failure warning and notification.

Heavy Vehicle Research

NHTSA's heavy vehicle research program is targeted at examining the functionality, performance, and safety benefits of a variety of advanced collision avoidance technologies as well as crash mitigation systems for heavy vehicles. The heavy vehicle research program addresses safety technologies that are both commercialized but perhaps not widely deployed, prototype and next generation safety systems, and multiple vehicle platforms including tractor-trailers or combination vehicles, straight trucks, buses, and motorcoaches.

Electronic Stability Control for Heavy Vehicles

In the area of crash avoidance, NHTSA's heavy

vehicle program is evaluating the performance benefits of electronic stability control (ESC). ESC systems can reduce loss of control crashes which often result in rollover or jackknifing.

Specific studies underway include testing at NHTSA's Vehicle Research and Test Center in Ohio to develop objective evaluation and performance measurement procedures (Figure 8). We are also completing safety benefit studies using hardware-in-the loop simulations, and clinical analysis of large truck crash reconstruction data to determine the effectiveness of stability control systems over a wide range of conditions.

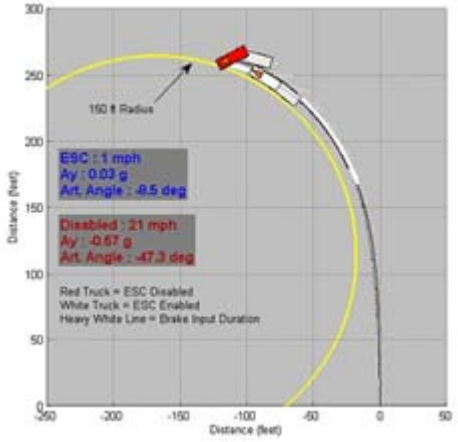


Figure 8. Stability Control Testing.

Forward Collision Warning (FCW), Collision Imminent Braking (CIB), and Lane Departure Warning (LDW) Systems.

NHTSA is also developing test procedures and evaluating the performance of current generation forward collision warning (FCW) systems with Collision Imminent Braking (CIB), as well as prototype systems that combine radar and optical sensors to improve object recognition, reduce "nuisance" warnings, and enhance autonomous braking performance. The work includes determining how such systems perform under a variety of pre-crash scenarios (Figure 9). Similar work is also underway for light vehicles.

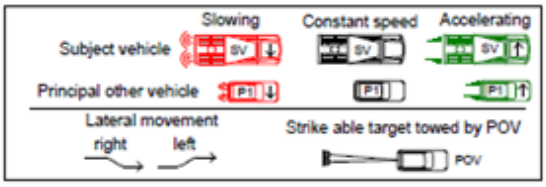


Figure 9. Examples of Pre-crash Scenarios.

Similar research is planned for Lane Departure Warning (LDW) systems. To determine how such systems perform in real-world conditions, NHTSA recently worked with industry partners on the Integrated Vehicle Based Safety System (IVBSS) program, a large field operational study, that combined FCW, LDW and side object detection technologies.

Vehicle Safety Communications for Heavy Vehicles

For several years NHTSA has been working with light-duty passenger vehicle manufacturers to develop and test innovative wireless communication technologies that would allow vehicles to have enhanced "situational awareness" by continuously broadcasting their position and heading at a rapid rate. This information is then received and interpreted by other vehicles. Warnings are presented to drivers if a crash situation is developing or imminent.

NHTSA is now extending this research to include heavy trucks and buses, and will aggressively tailor the technology and applications as needed to work in the unique operating environment characteristic of heavy vehicles. NHTSA is working with commercial vehicle partners to research and test the use of DSRC based vehicle-to-vehicle communications as a means of enhancing the performance of existing collision avoidance systems (such as FCW and LDW), but also enabling new collision avoidance applications for heavy vehicles such as intersection movement assist (IMA)

Vision Enhancement

Blind spots around large combination vehicles contribute to lane change/merge crashes, a significant portion of crashes involving tractor semitrailer vehicles. To address this type of crash scenario, NHTSA is examining the potential use of camera/video imaging systems (C/VIS) to augment side mirrors and help the driver perform safe lane change maneuvers. NHTSA is reviewing both commercially available C/VIS products as well as developing advanced prototypes which enhance the selected features of these systems including the ability to provide 360 degree all-weather vision for the driver. Test trials with commercial vehicle drivers were completed to determine the potential safety benefits, driver acceptance, and overall system performance for C/VIS technology.

Human Factors Research

NHTSA's human factors research examines the interaction of driver, vehicle, and environment in order to improve driver-vehicle performance. The research supports Federal Motor Vehicle Safety

Standards, safety defects investigations, consumer information, and the advancement of knowledge about driver behaviors and performance. Findings are applied to the development of vehicle technologies, which are compatible with driver abilities and limitations. Main focus areas of the Human Factors program include: (1) Reducing unsafe driving behaviors by addressing driver distraction and driver impairment (alcohol, drowsy driving), (2) Improving the driver-interface (DVI) design of Crash Warning Systems, and (3) addressing vulnerable populations, such as blind pedestrians by developing human factors requirements for quiet cars,

Driver Distraction

NHTSA's mission is to "save lives, prevent injuries, and reduce economic costs due to road traffic crashes." One focus of this mission is the prevention of road traffic crashes for which driver distraction is a contributing factor.

In April, 2010 NHTSA released an Overview of the National Highway Traffic Safety Administration's Driver Distraction Program which summarized steps that NHTSA intends to take to help in its long-term goal of eliminating a specific category of crashes-those attributable to driver distraction (NHTSA 2010b). NHTSA's Driver Distraction Program consists of four initiatives as illustrated in Figure 10, and described below.

Figure 10. NHTSA Driver Distraction Initiatives

Of the areas described in the plan, the Human Factors program supports initiatives 1-3, which are:

1. *Improve the understanding of the extent and nature of the distraction problem*. This includes improving the quality of data NHTSA collects about distraction-related crashes along with better analysis techniques.
2. *Reduce the driver workload associated with performing tasks using both built-in and portable in-vehicle devices by improving the designs of device interfaces*. Better device interfaces will help to minimize the amount of time and effort involved in a driver performing a task using the device. Minimizing the workload associated with performing non-driving, or "*secondary,*" tasks with a device will permit the driver to maximize the attention they focus toward the *primary* task of driving.
3. *Keep drivers safe through the introduction of crash avoidance technologies*. These include the use of crash warning systems to re-focus the attention of distracted drivers as well as vehicle initiated braking and steering to prevent or mitigate distracted driver crashes.

Distraction Guidelines

Of the projects listed under Initiatives, 1-3, a main focus is to develop a set of Distraction Guidelines in support of Initiative 2 – Reduce Workload from Interfaces. As discussed in NHTSA's Driver Distraction Program, NHTSA's intent is to "develop voluntary guidelines for minimizing the distraction potential of in-vehicle and portable devices."

Drivers perform secondary tasks (communications, entertainment, informational, and navigation tasks not required to drive) using in-vehicle electronic devices by interacting with them through their user interfaces. The user interfaces of these devices can be designed to accommodate interactions that are visual-manual, auditory-vocal, or a combination of the two. Some devices may allow a driver to perform a task through either manual control manipulation with visual feedback, or through voice command with auditory feedback to the driver.

In general there are two functional categories based upon the mode of interaction: visual-manual and auditory-vocal. Visual-manual interactions involve the driver making inputs to the device by hand (e.g., pressing a button, rotating a knob) and visual feedback being provided to the driver. Auditory-vocal interactions involve the driver controlling the device functions through voice commands and receiving auditory feedback from the device. Note that a single device's driver interface could accommodate both visual-manual and auditory vocal interactions.

At the present time, NHTSA Driver Distraction Guidelines are being developed for application to in-vehicle device tasks that are performed by the driver through visual-manual means. The goal of the NHTSA Guidelines is to encourage the design of in-vehicle device interfaces that minimize driver distraction associated with secondary task performance. The Guidelines specify criteria and a test method for assessing whether a secondary task

performed using an in-vehicle device may be acceptable for performance while driving. The Guidelines also seek to identify secondary tasks which interfere too much with a driver's ability to safely control their vehicle and to categorize those tasks as ones that are not acceptable for performance by the driver while driving.

Alcohol Detection Research: Driver Alcohol Detection System for Safety (DADSS)

Since 1997, about a third of all fatally-injured passenger vehicle drivers had blood alcohol concentrations at or above the legal limit. In order to address this problem, NHTSA entered into a five year cooperative agreement with the Automotive Coalition for Traffic Safety (ACTS) aimed at developing alcohol detection technologies with broad deployment potential. Desired technologies would be non-invasive, reliable, accurate, and precise. This program has been involved in the development and testing of alcohol detection prototypes and that may be installed in vehicles. The system prototypes are undergoing extensive laboratory and field testing. This five year effort will result in prototypes installed in test vehicles, and prevent alcohol impaired drivers from driving their vehicles.

Driver Impairment Monitoring

In 2010, the Impairment Monitoring to Promote Avoidance of Crashes using Technology (IMPACT) program developed real-time algorithms to detect driver alcohol impairment using vehicle-based sensors. The study developed two types of algorithm, a general algorithm that does not consider individual differences in driving and an individualized algorithm.

Ideally, one would desire both the capability of identifying impaired driving regardless of the source, and the capability of specifying the source of impairment. The IMPACT algorithms with slight modifications may present one or both capabilities in addition to detection of alcohol impairment. A follow on program, Advanced Countermeasures for Multiple Impairments (ACMI), aims to evaluate the breadth and specificity of the algorithms developed in IMPACT for use in detecting and distinguishing among multiple forms of driver impairment (alcohol impaired driving, drowsy driving, and distracted driving). The current phase of ACMI focuses on developing algorithms to detect drowsy drivers.

Collision Warning Interface Research

Recognizing the important role of the driver in crash avoidance systems, NHTSA is now focusing research on developing a better understanding of, and guidelines for, the collision warning interface for FCW and LDW systems. The work involves consideration of the unique driving environments for both light vehicle and commercial and heavy vehicle drivers. This work examines the effectiveness of various warning methods, determines the potential need for standardizing certain system features, and explores methods for objectively measuring the performance of interface solutions.

Quieter Car

Pedestrian safety can be compromised by modern vehicles, e.g. electric vehicles that produce little or no sound. The goal of this program is to understand the safety risks, characterize the acoustic environment, and identify possible countermeasures to enable pedestrians to detect the presence of vehicles in motion. Recent phases in the program have measured the effectiveness and acceptability of various countermeasures. Results will support agency rulemaking as directed by Congress, and reported elsewhere in this paper.

Data Collection and Analysis

NHTSA conducts a motor vehicle crash data collection program through the National Center for Statistics and Analysis (NCSA). It is composed of: the data collected from the states, including Fatality Analysis Reporting System (FARS) and the State Data Program. In addition, NHTSA also performs detailed crash investigations in the National Automotive Sampling System (NASS) Crashworthiness Data System (CDS) and the Special Crash Investigations (SCI) programs.

In the 1970s, NHTSA devised a method that utilizes a combination of State record and investigation based systems to provide nationally representative traffic crash data. The recoding of police-reported crashes from State record based systems into a uniform format provides counts and trends. T he detailed field investigations provide the details required for countermeasure development and evaluation. This sample based approach provides nationally representative data at a small fraction of the cost it would take to collect and manually recode the millions of police-reported crashes into a uniform format.

FARS is a State crash record based system that provides a census of all fatal crashes occurring on public roads in the United States. The NASS is comprised of the General Estimates System (GES) and the Crashworthiness Data System (CDS). The GES is a State crash record based system that provides national estimates calculated from the approximately 50,000 crashes collected annually to provide characteristics of all motor vehicle crashes. The CDS conducts detailed investigations into a nationally representative sample of approximately

4500 crashes involving towed passenger vehicles to investigate injury-causing mechanisms and to evaluate countermeasures.

The NASS infrastructure was utilized in two surveys to collect nationally representative data on the events and factors related to the causation of crashes. The Large Truck Crash Causation Study (LTCCS) was conducted by the National Highway Traffic Safety Administration (NHTSA) and the Federal Motor Carrier Safety Administration (FMCSA) from 2001 to 2003 collecting about 1,000 crashes providing information on the causes or contributing factors for large truck crashes. From 2005-2007, NHTSA conducted the National Motor Vehicle Crash Causation Survey (MMVCCS) which collected about 7,000 crashes providing nationally representative information on the events and factors related to the causation of light motor vehicle traffic crashes. The SCI program provides in-depth data on crashes where emerging issues may be of interest.

The Not-in-Traffic Surveillance (NiTS) system is a virtual data collection system designed to provide counts and details regarding fatalities and injuries that occur in non-traffic crashes and in non-crash incidents. The NiTS 2007 system produced an overall annual estimate of 1,747 fatalities and 841,000 injuries in non-traffic crashes and non-crash incidents.

NCSA also conducts key analyses of the collected data and publishes reports, including the Traffic Safety Facts Annual Report and Traffic Safety Fact Sheets. Copies of the most recent reports can be found at NCSA's web site using the following URL: http://www.nhtsa.gov/NCSA.

Significant Rulemaking Actions

Overview

NHTSA's vehicle Safety Rulemaking and Research Priority Plan provides complete details of the Agencies priority rulemaking efforts for the next two years (NHTSA, 2011a). The following provides a brief summary.

Improve Rear Visibility

This action pertains to FMVSS 111 and the Cameron Gulbransen Kids Transportation Safety Act of 2007 requiring regulation related to power window safety, rearward visibility, and rollaway prevention. On December 7, 2010, the agency published a Notice of Proposed Rulemaking (NPRM) proposing an image behind the vehicle be visible to the driver when in reverse. On February 28, the agency extended the comment period until April 18, 2011, and announced two public meetings to be held in March. A final rule publication is expected by December 31, 2011.

Sound for Hybrid Vehicles

This action pertains to the Pedestrian Safety Enhancement Act, to provide means of alerting pedestrians, especially those who are blind, to the presence of a motor vehicle in operation. Per legislation, the agency must initiate rulemaking by July 2012.

Heavy Vehicle Stability Control

After an extensive research program to evaluate the available technologies, an evaluation of the costs and benefits, and a review of manufacturer's product plans, NHTSA believes it is necessary to promulgate a new Federal standard that considers stability control systems on truck tractors and motorcoaches that address both rollover and loss of control crashes. Rollover and Loss of Control crashes' involving heavy vehicles is a serious safety issue that is responsible for 304 fatalities and 2,738 injuries. They are also a major cause of traffic tie-ups, resulting in millions of dollars of lost productivity and excess energy consumption each year. Suppliers and truck and motorcoach manufacturers have developed stability control technology for heavy vehicles to mitigate these types of crashes

Heavy Truck Tire Upgrade

This action pertains to FMVSS No. 119, applied to new pneumatic tires for motor vehicles with a GVWR of more than 4,536 kilograms (10,000 pounds) and motorcycles. This applies only to new tires, not to retreaded tires. On September 29, 2010, the agency published an NPRM proposing to upgrade FMVSS No. 119 by increasing the stringency of the endurance test, primarily by increasing the test speed, increasing the load, and lowering the inflation pressure, and adding speed rating labeling on the sidewall. A new high speed test with test speeds up to 75 mph was also proposed. An extended comment period closed on December 29, 2010. We expect to publish a Final Rule in 2012.

Keyless Ignitions

This action pertains to FMVSS 114, Theft protection and rollaway prevention. This rulemaking addresses three safety issues regarding Keyless Ignition systems: drivers' inability to shut down a moving vehicle, drivers failure to place the transmission in park before shutting off the vehicle (leading to rollaways when the driver exits the vehicle), and drivers inadvertently leaving a vehicle with the propulsion system active (leading to carbon monoxide poisoning if the vehicle is parked in a

garage adjoining a living space). The agency expects to publish the NPRM in 2011.

Accelerator Control Systems

This action pertains to FMVSS 124, accelerator control systems. The issues are: (1) updating the throttle disconnection safety requirements and test procedures of the standard to better address electronic throttle control and alternative power trains; and (2) adding a new requirement for a brake-throttle override system on light vehicles. The agency expects to publish the NPRM in 2011.

Lighting

FMVSS No. 108 has been in existence since 1968. The standard had been amended over the years but has never undergone a comprehensive review. Regulated parties had stated that the standard was difficult to interpret because of its organization. In response to these concerns the agency sought to rewrite the standard to make it more understandable by adopting a simplified numbering scheme, to improve organization by grouping related materials in a more logical and consistent sequence, and to reduce the certification burden of regulated parties who previously needed to review a few dozen third-party documents. The agency issued a final rule on December 4, 2007. Several petitions for reconsideration of the Final Rule are under consideration and the agency will decided on these in 2011.

Speed Limiters for Heavy Trucks

In 2007, NHTSA was petitioned by the American Trucking Association and Roadsafe America to require the installation of speed limiting devices on heavy trucks. In response, NHTSA requested public comment on the subject and received numerous comments supporting the petitioner's request. The agency has granted the petition. The agency anticipates issuing a proposal in 2012.

Tire Aging

Tire Aging refers to the reduction in a tire's material properties, which over time leads to a reduction of its performance capabilities and could result in tire failure. As a result of the agency's comprehensive tire aging research program, we have developed a tire aging test protocol that includes 5 weeks in the oven, which is followed by roadwheel testing. The protocol is available in docket NHTSA-2005-21276. Validation tests are being conducted on several currently produced light vehicle tire models to evaluate their performance to the test protocol. After completion of validation testing, the agency will decide on the next steps in 2011.

Next Generation New Car Assessment Program (NCAP)

In the final decision notice published on July 11, 2008 (73 FR 40016.Docket No.NHTSA-2006-26555), NHTSA discussed possible future enhancement efforts (beyond the newly enhanced program) in frontal impact, side impact, rear impact, and rollover programs. The agency will consider updating injury criteria in frontal impact and side impact programs, adjusting the baseline injury risk in all three programs to ensure that vehicles are measured against a meaningful benchmark, revising testing protocols, and providing improved consumer information.

The agency also plans to conduct real-world crash data analyses to identify crash modes and additional beneficial advanced technologies for the NCAP program beyond electronic stability control (ESC), lane departure warning (LDW), and forward collision warning (FCW) systems.

Motorcoach Safety – Seat Belts and Structural Integrity

Between 1999 and 2008, there were 24 fatal motorcoach rollover events that resulted in 97 deaths. Seventy-six of those 97 were ejected from the motorcoach. The agency published a proposal to require lap/shoulder belts for all seating positions in motorcoaches on August 18, 2010. This rule is intended to prevent ejections and keep passengers in their seats, thereby mitigating fatalities and injuries in crash and rollover events. A final rule is expected in 2012. In addition, the agency is developing a proposal for enhancing motorcoach rollover structural integrity in 2011.

Child Passenger Safety

In 2005, the agency issued a proposal to further expand the applicability of FMVSS No. 213 to CRSs for children weighing up to 80 lbs by incorporating the Hybrid III 10-year-old child (HIII-10C) dummy into the standard. After publishing two supplemental notices in 2009 and 2010 to address technical issues, the agency is planning to issue final rules in 2011 to incorporate the HIII-10C dummy into Federal motor vehicle safety standards.

The agency has evaluated and enhanced a test procedure simulating a near side impact of CRSs in vehicle side crashes and has also evaluated a new 3-year-old side impact child dummy, "Q3s" for use in this test procedure. The agency will propose the test procedure, performance requirements and the new Q3s dummy for evaluating child restraints in side impact in 2011.

In February 2011, NHTSA announced its intent to launch a new initiative as part of the New Car Assessment Program to provide consumers with information from auto manufacturers about the specific child safety seats they recommend for individual vehicles (76 FR 10637, Docket No. 2010-00062). Vehicle manufacturers would recommend a minimum of three seats from each of the three child restraint system type categories, rear facing, forward facing, and booster, and would span across a range of price points. Participation in the program would be voluntary. Following a public comment period, NHTSA anticipates issuing a final notice of the program in 2012.

Roof Crush

On May 12, 2009, NHTSA published a final rule upgrading the requirements of FMVSS No. 216, "Roof crush resistance." For light vehicles, the rule doubles the amount of force the vehicle's roof structure must withstand in the specified test, from 1.5 times the vehicle's unloaded weight to 3.0 times the vehicle's unloaded weight. The rule also requires the vehicles to meet the specified force requirements in a two-sided test, instead of a single-sided test and established a new requirement for maintenance of headroom. Previously unregulated vehicles with a gross vehicle weight rating greater than 2,722 kilograms, but not greater than 4,536 kilograms, are now required to have a roof strength of 1.5 times the unload vehicle weight under the same test conditions. The agency estimated that the changes in this standard will prevent 135 fatalities and 1,065 nonfatal injuries annually. Manufacturers would have to begin producing vehicles that meet the standard during 2012 (2013 model year) and all new light vehicles would have to meet the standard by September 1, 2016 (2017 model year).

Ejection Mitigation

On January 19, 2011, NHTSA published a final rule establishing the new Federal Motor Vehicle Safety Standard (FMVSS) No. 226 on Ejection Mitigation (NHTSA 2011b). This standard will reduce the partial and complete ejection of light vehicle occupants through side windows in crashes, particularly rollover crashes. We estimate the final rule will save 373 lives each year and prevent 476 serious injuries when fully implemented. Manufacturers would have to begin producing vehicles that meet the standard during 2013 (2014 model year) and all new light vehicles would have to meet the standard by September 1, 2017 (2018 model year).

Safety of Electric Powered Vehicles

NHTSA issued a final rule in June 2010 to facilitate the development and introduction of fuel cell vehicles and the next generation of hybrid and battery electric powered vehicles. The final rule requires manufacturers to design their electrically powered vehicles so that, in the event of a crash, all high voltage components of the power train are either electrically isolated from the vehicle's chassis or their voltage is below specified levels considered safe from electric shock hazards.

Evolving Vehicle Safety Strategy

Safety technology continues to evolve at a fast pace. Government agencies, acting alone, cannot expect to keep up with this pace. NHTSA believes it must continue to explore collaborative models with all stakeholders, such as OEMs, suppliers, research centers, advocates, and other government agencies. These collaborative models provide for a more transparent technology development and implementation process, significantly reducing the time for advanced safety technologies to reach the consumer.

In sum, our Vehicle Safety Strategy is designed to proactively expand our focus on vehicle safety needs and to dynamically manage our safety programs in a culture of accountability and global leadership. It constitutes a method for managing our responses to vehicle safety needs through a flexible but disciplined approach that keeps pace with changing vehicle safety priorities over time. As new opportunities for vehicle safety emerge from our strategy, our methods will help to ensure a clear path of transition of these to main stream vehicle safety programs, such as those described through the body of this paper.

References

1.) Allen, K. (2010). The Effectiveness of Underride Guards for Heavy Trailers. DOT HS 811 375.
2.) National Highway Traffic Safety Administration. (2011a). NHTSA Vehicle Safety and Fuel Economy Rulemaking and Research Priority Plan 2011-2013. Docket No. NHTSA–2009–0108.
3.) National Highway Traffic Safety Administration (2011b). Docket No. NHTSA-2011-0004.
4.) National Highway Traffic Safety Administration. (2010a). Docket No. NHTSA-2010-0112.
5.) National Highway Traffic Safety Administration. (2010b). Driver Distraction Program. DOT HS 811 299.
6.) Rudd, R.W., Bean, J., Cuentas, C., Kahane, C.J., Mynatt, M., and Wiacek, C. (2009).A Study Of The Factors Affecting Fatalities Of Air Bag And Belt-

Restrained Occupants In Frontal Crashes. In: Proceedings of the 21st Enhanced Safety of Vehicles Conference, Paper No. 09-0555.
7.) Takhounts, E.G., Hasija V., Ridella, S.A., Rowson, S, and Duma, S.M. (2011). Kinematic Rotational Brain Injury Criterion (BRIC). In: Proceedings of the 22nd Enhanced Safety of Vehicles Conference. Paper No. 11-0263.