STATUS REPORT, FEDERAL REPUBLIC OF GERMANY

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21st ESV-Conference

Stuttgart, 15th to 18th June 2009

INTRODUCTION

Technical progress in automotive engineering focuses at the moment on two branches: improving safety and reducing energy consumption. While vehicle safety has been on the agenda for many decades by now, the emissions of greenhouse gases are a topic of the last years. The reduction of fuel consumption is driven by two issues. On the one hand CO_2 has to be reduced since it is seen as a major factor for global warming. On the other hand the resources of fossil crude oil will come to an end. The latter also will lead to increasing fuel prices in the long term future.

However every cent for research in automotive engineering can be spent only once. Thus safety and CO_2 reduction somehow compete with each other. Rulemaking of regulations on ECE-level or directives on EU-level has to face this tension to an increasing amount. The mandatory introduction of safety measures has to be justified convincingly if higher vehicle masses or additional fuel consumption are accompanying the measure. So cost benefit analyses and impact assessments, which are already a prerequisite for legislation, will in the future not only focus on the effects of the safety measure alone but also on its side effects, especially with regard to CO_2-emissions. It can be expected that also primary and secondary safety measures will be weighted against each other in order to introduce the most effective measure with regard to safety, climate protection and costs. This third factor besides safety and CO_2, namely costs for the consumer, stepped into the foreground during the last months when sales figures of vehicles decreased. Only vehicles, which the consumer can afford, will be bought. Thus, it is an essential goal for automobile manufacturers, suppliers and legislators to enable market introduction of safety systems which are beneficial but cheap enough for high market penetration.

The Challenge of Demographic Change for Road Safety

Decreasing fertility rates and a continuous increase of the average life expectancy lead to a considerable medium- or long-term change in age structure in Germany as well as in other industrial nations. By 2030, current investigations predict a reduction of Germany's population of more than 5 million to about 77 million inhabitants. It is, however, not the long-term decrease in population but moreover the change in the population structure that is the real challenge. Compared to 2005, in 2030, for example, the percentage of children and young people will be reduced by a quarter. The number of persons of working age will also be reduced considerably by 15%. In contrast, the percentage of elderly people (persons older than 65) will increase by about 40%. In addition to that, it is expected that the development of the Federal States and regions regarding their total population as well as their economy will differ considerably.

This development means an increasing participation of elderly people in road traffic. In addition to that, the senior citizens of tomorrow will be more mobile than the ones of today. Elderly women in particular will increase their vehicle-mobility considerably compared to the situation as it is today. Consequently, in future, road safety aspects of elderly people will be much more important than today.

Effects on the other age groups are, however, expected as well. Based on the regional disparities, declining regions will experience - for instance - a decrease of schools and doctor's practices in number and density so that a long-lasting change in mobility thus in road safety is to be expected here as well. The demographic change thus represents one of the big challenges for the future work in the field of road safety.

Road accidents in Germany

The number of road accidents decreased continuously for many years until 2006 – by nearly 5% to 2,235,318 road accidents in 2006. Although 2007 was an extraordinary year with increasing accident figures for the first time in years (2,335,005 road accidents), on the long run, accident figures have still decreased. Moreover, the forecast for 2008 indicates once again a further decrease in accident figures (2008: 2.27 million road accidents).

The number of road accidents with personal injury has decreased by more than 12% since 2000, resulting in 335,845 road accidents with personal injury in 2007. For 2008 a further decrease of more than 4% to approximately 321,000 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 nearly 15% from 511,577 in 2000 to 436,368 in 2007. For 2008 a reduction of approximately 5% compared to 2007

has been predicted – to about 414,000 casualties in 2008.

Since 2000, the number of severe injuries has been reduced by 26% to 75,443 seriously injured road users in 2007 and the number of slight injuries has been reduced by 11% to 335,971 slightly injured road users. Fatalities have decreased by 34% from 7,503 fatalities in 2000 to 4,949 fatalities in 2007 – which is the lowest number of fatalities ever recorded by the national road accident statistics. For 2008, a further reduction to 4,500 fatalities has been predicted.

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 12,500 km of federal motorways in 2007 were about 49,200 vehicles per 24 hours on average (ADT). Figure 1 gives an overview of the distribution within the federal motorway network.

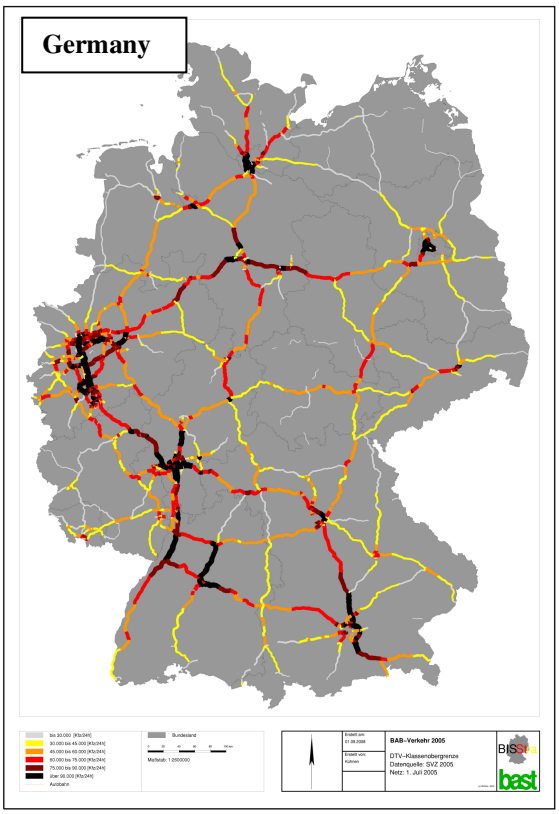

Figure 1. ADT of all vehicles on federal motorways in 2005

The ADT of vehicles with a permissible total weight of above 3.5 t was on federal motorways in 2007 about 7,600 heavy vehicles. Figure 2 shows the situation in the year 2005.

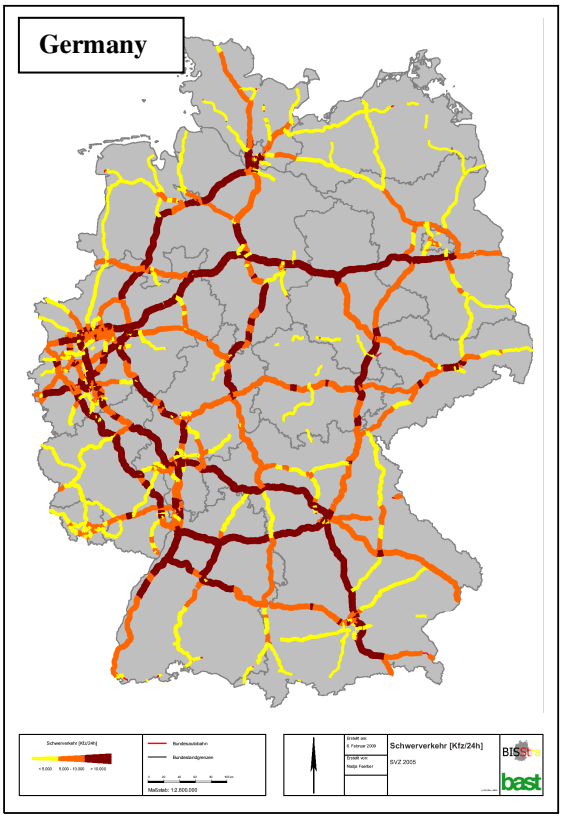

Figure 2. ADT of trucks > 3.5 t on federal motorways in 2005

The total driving performance of all vehicles in 2007 was about 692.0 billion vehicle-km, out of which over 30% took place on the federal motorways alone.

Freight Transport and Logistics Masterplan

A modern industrial and service economy based on the division of labour and a successful business location cannot function without an efficient transport system. Current studies forecast a growth in tonne kilometres of around 70 % between 2004 and 2025. Closely linked with this growth are environmental and climate change challenges. Today, already, transport is responsible for around 20 percent of CO_2 emissions and accounts for around 70 % of total petroleum consumption.
The Federal Government has responded to these challenges by publishing the Freight Transport and Logistics Masterplan in summer 2008. It describes the strategic transport policy direction and the key elements of the future course of action which are to be used to ensure the provision of efficient infrastructure and, at the same time, to reduce the amount of energy consumed by vehicles and make transport more efficient, cleaner and quieter.

The Masterplan contains a total of 35 concrete measures subsumed under the following six objectives:

- Making optimum use of transport infrastructure - shaping transport to make it more efficient

  The aim is to enhance the capacity of the overall transport system. Optimum use is to be made of existing transport infrastructure and the transport system is to be made more efficient. Measures to tackle congestion will be intensified and continued. In concrete terms, this means: road works management will be optimized, traffic management systems will be linked up and the provision of necessary parking areas for HGVs on motorways will be accelerated.

- Reducing the number of journeys - ensuring mobility

  The aim is to improve transport chains, for instance by optimizing transit traffic. Developing the European networks or making greater use of short-sea shipping can help to achieve this aim. An initiative for better logistics in urban areas is designed to make freight transport in towns and cities more efficient, thereby enhancing the quality of life in conurbations.

- Transferring more traffic to the railways and inland waterways

  Greater use is to be made of environmentally friendly modes of transport, such as the railways and inland waterways, for freight transport. To this end, the funding for combined transport will be increased from 62.5 million to 115 million Euros per annum. A support programme is to provide financial assistance to innovative handling technologies in combined transport. A strategy will be developed to take account of the European discussion on the internalisation of all external costs (e.g. for air pollution, climate change, noise or congestion). This will produce greater transparency regarding the nature and level of the costs to the economy of the individual modes of transport.

- Upgrading more transport arteries and hubs

  Despite all the efforts to enhance efficiency, there are still bottlenecks in the transport infrastructure. For this reason, transport arteries and hubs are to be upgraded. This means a segregation of passenger and freight services by reducing pathing conflicts on the railways and by taking targeted action to remove bottlenecks on the railways and roads. This will require a higher level of transport investment, and this is reflected in the 2009 budget estimates and the Federal Government's medium-term financial planning.

- Environmentally friendly, climate-friendly, quiet and safe transport

  Alongside noise mitigation on the railways, the focus is on tightening environmental and safety standards in order to reduce noise and pollutant emissions and the risk of accidents and on shifting traffic to more environmentally friendly modes of transport. In addition, a strategy is to be developed for varying tolls according to the route driven and the time of day. Such a strategy would make it possible to charge a higher toll on busy sections of motorway at certain times of day, while reducing the toll at other times of day.

- Good working conditions and good training in the freight transport industry

  The conditions of working and training in the freight transport industry are to be improved. This includes a training initiative and regular monitoring of the working conditions in the freight transport and logistics sector, plus ensuring that sufficient checks are carried out to enforce compliance with social legislation in the road haulage sector.

German Presidency of the EU Council

The German EU Council Presidency has addressed the European Commission's eSafety initiative and organised a conference on this initiative on 5/6 June 2007 together with high-level representatives from the Commission's Directorate-General involved, from the Member States, national and European associations, the automotive and supplier industry, monitoring agencies, automobile associations and research institutions. Against the background of the White Paper, development prospects of intelligent mobility were discussed. Being of particular importance, the following thematic blocks were given special attention during the discussion:

- Block 1:
  Real Time Traffic Information (RTTI) / Communications - Enhancing Traffic Information

- Block 2:
  Human-Machine Interaction (HMI), including eSecurity - the human-machine interface to car multimedia systems, tamperproof technologies

- Block 3:
  Driver Assistance Systems (DAS) - legal situation and assessment, including the new role of motorists in partially automated in-car processes, plus EuroNCAP testing procedures for DAS

The eSafety Conference adopted conclusions regarding these thematic blocks. They were based on the results obtained at European level by the working groups, on the expert presentations from representatives of various Member States and European institutions and on the discussion result. The results of this Conference have been considered trend-setting by the European Commission [KOM(2007) 541, dated 17th Sept 2007]. Detailed conclusions are summarised below in the chapter research as topics "HMI", "RTTI", "legal issues of ADAS" and "eSecurity".

RESEARCH

Daytime Running Lights for Motorcycles

The problem of conspicuity of motorcycles during the day is also well known in Germany since many years and there are different national and international proposals to enhance conspicuity by improvement of the frontal signal pattern of motorcycles. In accordance with the application laws of many countries, motorcycles currently have to drive with activated passing beam headlamps. Additionally for multilane vehicles, it is already allowed in many countries to drive with dedicated daytime running lamps.

Figure 3. Motorcycle with passing beam

This is why the Federal Ministry of Transport, Building and Urban Affairs has assigned the Federal Highway Research Institute (BASt) with the task of investigating the conspicuity of motorcycles under daytime conditions more precisely. This research project was completed in July 2008. The results of the study can be summarised as follows:

One dedicated daytime running lamp on a motorcycle is better recognisable than the normal passing beam. Two dedicated daytime running lamps are better recognisable than a single daytime running lamp (see figures 3 and 4). Dedicated daytime running lamps with a high luminous intensity are better recognisable at greater distances than daytime running lamps with a low luminous intensity, whereas the differences in the conspicuity caused by different colours respectively colour regions of the daytime running lamps fade with greater distances.

Figure 4. Motorcycle with different kinds of dedicated daytime running lights, two of them illuminated

The research project into conspicuity of motorcycles has shown that under daytime conditions an improved perception of such vehicles equipped with daytime running lamps will be provided. Germany therefore sees an improvement for road safety by replacing the passing beam function by dedicated daytime running lamps on a motorcycle. This will increase the vehicle visibility and will be favourable for the lifetime of the light sources used in the passing beam headlamps of the motorcycles.

These results led to German proposals for amendments to ECE-Regulation No. 53 and No. 87 of the UNECE in October 2008.

Safety of Hydrogen Vehicles

Hydrogen is one of the future alternative fuel concepts that is attributed to have a great potential in the automotive sector. The new technology is very challenging for the vehicle sector and puts great demands on its safety. The storage of hydrogen in the vehicle or the crash-safety of these vehicles are good examples for that. To avoid an unlegislated area and to protect people of avoidable risks it was decided on an international basis to develop a GTR (Global Technical Regulation) for hydrogen vehicles. A completed GTR would enable the manufactures to easily introduce the new technology of hydrogen vehicles worldwide. The GTR for hydrogen vehicles contains environmental as well as safety aspects of these vehicles. The Federal Highway Research Institute (BASt) supports the Federal Ministry of Transport, Building and Urban Affairs with regard to safety matters of these vehicles during the development process of the GTR. In parallel to the development of the GTR the European Commission currently works on an EU-Regulation for hydrogen vehicles to enable the approval of these vehicles in Europe in a shorter timeframe. After coming into force the completed GTR should then substitute the EU-Regulation for the approval of vehicles in Europe again.

Elements of active vehicle safety for elderly drivers

Several systems and elements concerning active vehicle safety are offered on the market today. These are normally targeted at all drivers. With a view to the demographic trend it is appropriate to analyse the benefit of these systems especially for senior citizens. The aim of a research project carried out on behalf of BASt is to compile a catalogue of criteria for the evaluation of active vehicle safety devices with regard to the value added for elderly drivers.

Within the scope of this project some systems (e. g. brake assisting systems or active steering) are selected as examples out of a comprehensive demand and market analysis. Their effect on active vehicle safety will be then tested in driving tests with test persons between 65 and 80 years of age (see figure 5).

The findings which will be derived besides the driving tests from questionnaires and interviews will be used as a basis for the catalogue of criteria. Final recommendations will illustrate how such products have to be structured to suit the special requirements of senior drivers.

Figure 5. Driving test for the examination of brake assisting systems (BAS)

Periodical Technical Inspection of electronically controlled systems in road vehicles

More and more vehicles are equipped with driver assistance systems which are electronically controlled. Most of them are implemented to increase safety or decrease pollution, some of them are used for comfort reasons.

Especially the safety potential of advanced driver assistance systems is enormous. Remarkable examples are the ESC (Electronic Stability Control) system, the emergency brake system for trucks or easier systems like ABS or a simple traction control. All these systems help to increase safety during driving if they work properly. The problem is that these systems were not checked during the periodical technical inspections (PTI). Thus, on account of possible system failures, abrasion, unauthorised removal and manipulation, the original safety potential of modern vehicles can be reduced over the entire period of use (see for example figure 6). However for safety reasons, the benefit delivered originally by the electronically controlled systems should actually remain the same over the whole vehicle life.

Pursuant to article 5 of directive 96/96/EC, Member States may already include function and efficiency tests for advanced driver assistance systems in the periodical technical inspection of vehicles.

Figure 6. Manipulation of the level sensor for the rear axle of a passenger car

The German government in cooperation with PTI organisations and the automotive industry has designed the periodical technical inspection of electronically controlled systems. With the regulation pursuant to article 29 and annex VIII of the German road traffic type approval law (StVZO) the German government established that the following vehicles have to be checked with regard to certain electronically controlled safety devices during the PTI:

- all vehicles with a date of first registration before 1st of April 2006,
- all vehicle types (passenger cars, motorcycles, trucks and trailers)

All systems which can be allocated to eight relevant system classes are checked during the PTI (see figure 7).

Relevant vehicle system classes	
1	Braking system - Overall system
2	Steering system – Overall system
3	Headlights and lamps
4	Seat belts and restraining devices
5	airbag
6	Roll-over protection features
7	Driving dynamic systems that intervene with braking system
8	Speed limiters

Stand Januar 2009

Figure 7. Relevant vehicle system classes

The data for the inspection of the electronically controlled systems are stored in a central database. For that reason the PTI organisations installed an institution (called FSD GmbH) in Dresden in 2004 which is responsible for the database. The data for the tests is delivered by the vehicle manufacturers and adapted to testing purposes by FSD. The data comprises information about relevant built-in systems, the identification features and testing methods. For carrying out a PTI and checking the relevant systems the test engineers have direct access to these data.

This new electronic test within the PTI in Germany which goes far beyond the minimum requirements for PTI in Europe can be seen as a pilot project for future testing procedures for electronically controlled safety devices to be regulated in the 96/96/EC.

At present, FSD together with the Federal Highway Research Institute of Germany (BASt) are carrying out a research project to validate the introduction of testing of these systems which will be finished in 2010.

Pedestrian Protection

FlexPLI

A flexible pedestrian legform impactor that is being considered for implementation within global legislation on pedestrian protection (GTR) is currently being evaluated by a Technical Evaluation Group (FlexTEG) of GRSP (Working Party on Passive Safety) of the UNECE (United Nations Economic Commission for Europe). The impactor shows various significant advantages with regard to its biofidelic properties when being compared to the EEVC WG 17 pedestrian legform impactor that is used within the current European legislation. The final built level Flex-GTR is being expected to avoid dissymmetries and knee twists of the previous version that caused a partly high deviation in the ligament elongation results. The robust impactor so far proved the compatibility of current pedestrian protection packages of modern car fronts with the biofidelic properties of built level GT. Only the loads on the medial collateral ligament partly exceeded the proposed injury thresholds, whereas the cruciate ligament as well as the tibia criteria could be fulfilled from most of the so far tested European bumper structures. Due to the fact that no transfer function between the knee bending angle and the cruciate ligament results has been developed, their use as injury criteria has not finally been decided yet. On the other hand, new tentative knee and tibia injury threshold values have been proposed by JAMA and BASt. The evaluation of the final built level started in early 2009. BASt developed a new impactor certification method and was the first lab world-wide performing real car tests with the Flex-GTR. Subsequent to the publication of GTR No. 9 in the global registry of the United Nations a new GRSP informal group is expected to take over the FlexTEG activities in order to develop the GTR phase II.

Pedestrian head impact test procedure for the windscreen and the windscreen frame area

In a research project carried out by IKA Institut für Kraftfahrzeuge Aachen on behalf of BASt, new pedestrian head impact test methods for the windscreen and windscreen frame area have been developed. Those test methods use a combination of simulation and subsystem testing that allow a definition of more realistic test conditions regarding potential impact points and timing of the head. By combining simulation and dummy tests the analysis of vehicle pedestrian collisions of future vehicles with deployable systems will be possible. Tests with pedestrian dummies represent real world pedestrian accidents in a more realistic way such that the output of those dummy tests can be used for the further analysis of real pedestrian accidents. Simulations with human models and Polar dummy test results show a good correlation with respect to impact point and timing. As an extension of the test methods, further simulations could include FE human body models or coupling between FE and multibody models. Within a comparative study of the benefit of external airbag-equipped vehicle front structures to current non-activated ones HIC values, neck compression forces and neck moments show significant reductions. In a next stage, the test procedure is thought to be extended with respect to active pedestrian protection systems, including sensor systems.

Compatibility

Vehicle safety has been improved in Europe with the introduction of legislative and consumer testing. The reduction of road casualties over the last decade can be attributed to advances and improvements of self protection systems. Stronger occupant compartments and improved occupant restraint systems are evident in the higher assessments awarded in the Euro NCAP testing programme. However, in today's passive safety tests the role of the collision partner is not reflected. Significant evidence from 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. In vehicle-to-vehicle accidents, both the self and the partner protection are important for overall safety. Until vehicle-to-vehicle crash compatibility is controlled through objective test procedures, significant gains in road safety are not be addressed as specified in the EC white paper [1].

The relevance of vehicle compatibility cannot be ignored for improving road safety. As reported by EEVC WG15 to the GRSP in May 2007 [2], frontal impacts account for 16,000 fatalities and 122,000 serious injuries in the EU15 annually. Based on the work in VC-Compat [3], 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 EU25. The exact safety benefit to this target population could not be determined in the VC-Compat project and thus motivates a need to further pursue compatibility research to improve the outcome of a significant proportion of EU road casualties. The conservative estimates in VC-Compat concluded that an additional consumer cost of 300 € would be necessary to implement compatibility measures that would benefit this target population. These costs can be significantly reduced if new vehicle designs start with sound compatibility design and assessment approaches. Using a tight relationship with the automotive industry and safety researchers, this project proposal aims to develop concrete improvements in vehicle safety via improved compatibility performance. Some early estimates indicate that improved compatibility can reduce the annual cost of traffic injuries for society by € 2 billion per annum.

The proposed European research project FIMCAR aims at proposing an assessment approach (assessment approach describes test procedure(s) including the assessment; approach is used, as a suit of assessment procedures might be selected.) for vehicle-to-vehicle frontal compatibility which could be accepted by European research organisations and industry also taking into account the harmonisation with world-wide activities. This proposal will be a solid base for future regulation and would overcome the existing uncertainty that the European automotive industry has concerning vehicle-to-vehicle compatibility. In the process of developing test and assessment procedures for compatibility, the unified automotive industry in FIMCAR will be incorporating the fundamental knowledge needed to design and manufacture vehicles meeting or exceeding required crash compatibility performance. This research project and resulting assessment approach would thus lead to a reduction of road accident casualties and would strengthen the position of the European car manufacturers as vehicle-to-vehicle compatibility is a world-wide concern.

Based on previous research work towards compatibility (e.g., EUCAR Compatibility project, EEVC WG15, VC-COMPAT and other international and national research projects and working groups), the main issues for improving compatibility are:

- Compartment strength and stability
- Global force level matching
- Structural interaction

Although several test approaches have been proposed, no final decision has been taken for an appropriate assessment of compatibility in Europe, Asia or North America.

Within the EC funded VC-COMPAT project, two different tests have been developed to test a vehicle's compatibility performance.

- These is the first approach using an off-set test against a progressive deformable barrier (PDB) complemented by a full overlap test against the rigid wall and
- a second approach being a full width test against a deformable barrier (FWDB) supplemented by an off-set test according to ECE R94.

Both procedures use an off-set test and a full overlap test.

An additional test candidate has been developed that promises to be a long term alternative for testing compatibility. Research towards the assessment of compatibility by a moveable deformable barrier test has been initiated and mainly supported by the Alliance of Automobile Manufacturers. Activities in Europe are necessary to monitor the developments of this approach.

For frontal impact protection, at the GRSP meeting in December 2007 France made a proposal to amend Regulation 94 [4]. The main changes proposed in the amendment were:

- Obstacle
    - Current Offset Deformable Barrier (ODB) to Progressive Deformable Barrier (PDB)
- Test parameters
    - Test speed: 56 km/h to 60 km/h
    - Vehicle Overlap: 40% to 50%
    - Barrier ground clearance: 200 mm to 150 mm

This initiative may result in modification of the current European self protection test standards. It is however important that in the first place any change in self protection test standards must have regard to compatibility issues. Thus the FIMCAR project is timely as the introduction of compatibility test procedures must be initiated during the review of Regulation 94.

Child safety

In 2009 two BASt research projects in the field of child safety in cars are finalized.

One project dealt with the subject “Misuse of airbag deactivation when transporting children in child restraint systems". In all member states of the European Union the deactivation of a present passenger airbag is mandatory if a child is carried in a rearward facing child restraint system at the front passenger seat. Today there are a lot of different airbag deactivation “philosophies”. Solutions like dealer disconnection, an on/off-switch, or the automatic detection of a child restraint system may be mentioned as an example. Two types of misuse can occur: transportation of an infant while the airbag is (still) enabled and transportation of an adult, while the airbag is disabled. Within the project both types of misuse were analysed by two types of surveys among users. Additionally an accident analysis was conducted and some dynamic and static tests were conducted to examine the potential risk for present and future airbag generation.

The second project finalized 2009 addressed the “Changing body sizes and weights in the case of older children with respect to the testing, assessment and use of child restraint systems”. According to the German road traffic regulations children up to the age of 12 or a body height below 150 cm have to use approved and appropriate child restraint systems (CRS). CRS must be approved according to UN-ECE Regulation No. 44. The largest group within ECE R44 allows approving CRS for children weighting 22 kg up to 36 kg. Several studies show, that today many children reach the limit of 36 kg with a stature less than 150 cm. Within this project German anthropometric data from children was evaluated to determine the current size and weight distributions. Based on this data 4 dummies with different heights and weights were defined and built, based on the P10. Different child restraint systems were tested with respect to the ECE R44 regulation, using these dummies to determine the potential for protection in existing child protection systems for larger or heavier children.

Euro NCAP

<u>Child Restraint Systems (CRS)</u>

Germany suggested to change the current NCAP child protection assessment protocol, with the aim to clearly improve consumer information. It shall motivate the CRS industry to develop well performing CRS for smaller children (to become a “Top Pick” seat) and the vehicle manufacturer to develop robust interfaces with more than one seat in mind. It shall include new aspects such as e.g. misuse and it will be a clear challenge to the OEM to work on the protection of larger children respectively small adults on rear seats.

The current Euro NCAP Child Protection Assessment has improved the vehicle’s – CRS interface,

but only a limited number of child seat manufactures and even less CRS models are affected (small, expensive segment). The impact on aftermarket and the added value for the consumer is small. It is doubtful, if consumers understand that the rating is valid only for this vehicle – CRS combination. There are limitations with regard to the biofidelity of dummies and biomechanical basis of criteria. The actual Euro NCAP Child Protection Assessment focuses on younger children only and does not adequately address real-world misuse. At the moment Euro NCAP makes demands on the OEM, the OEM makes demands on the CRS manufacturer, who will in effect be responsible for the Euro NCAP result. The protocol does not provide a clear incentive to promote rearward facing CRS. Within the dynamic Euro NCAP car tests, the young children should be replaced by older children. The CRS assessment for smaller children should be separated from car assessment and an independent CRS classification could include misuse, ease-of-use and dynamic results. From this a "Top Pick" list could be generated for a CRS - vehicle interface assessment. The child protection assessment for the car should be based on a CRS - vehicle interface assessment, the front/side dynamic score for older children and on the vehicle based assessment. Additionally a "shopping list" (seats fit to the car) can be developed from the interface assessment and published.

Light Commercial Vehicles

In addition Germany suggested the implementation of a new NCAP assessment to rate Light Commercial vehicles (LCVs). By now, Euro NCAP did not consider Commercial vehicles. The need to do so in the near future increases with the rising number of such vehicles on European roads. Whereas the number of passenger cars increased by 30% in the last 15 years (German figures) the number of Commercial Vehicles (GVW < 3.5t) has doubled. Because of their high crash weight, Light Commercial Vehicles need to have highly efficient energy absorbing crash structures. This conflicts the economic objective of maximizing cargo space. Accident data shows that there is a similar accident risk for personal damage accidents for Commercial Vehicles and for passenger cars (around 9 out of 1000 registered vehicles). Taking into account, that Commercial Vehicles are not driven by typical “high risk groups” - e.g. leisure trips by night and by young people - , the accident risk for Commercial Vehicles is high. Accident modes are different from those of passenger cars but dominated by pole impacts and crashes with trucks and other passenger cars.

Benefits are expected, primarily in the reduction of severe injuries to Commercial vehicle occupants as well as to their crash opponents. The application of Primary Safety Assessment will tackle about 40% of all Commercial Vehicle casualties. Primary Safety assessment is expected to have the greatest ad hoc impact on a short-term basis, since passive safety assessment is currently limited with respect to Commercial vehicles crash modes (e.g. truck accidents). None the less test procedures for compatibility as well as an adaptive pedestrian test for CV are intermediate-term issues. Improving self protection by short-term secondary safety assessment can however address another 20% to 30 % of all Commercial vehicle casualties.

The achievement of such expectations is well-grounded. Primary safety functions (BAS, ESP, ACC, SBR) are already an option and can be introduced at once. Justification to meet the anticipated advantages has been given by several efficiency studies (Gwehenberger, Kiebach, Zlocki et al.). Furthermore recent German studies (BASt, DEKRA) have shown that current Commercial vehicles are already able to pass the frontal ODB test. A similar result is expected for the pole test, which makes both tests realisable on a short-term basis. Pedestrian safety assessment has to be adapted on an intermediate-term basis.

German Field Operational Test on Car-to-Car- and Car-to-Infrastructure Systems (SIM-TD)

SIM-TD – Sichere, intelligente Mobilität - Testfeld Deutschland (“Save and intelligent mobility – field trial Germany”) is a project dealing with the development of a technology that allows communication between vehicles and an intelligent roadside infrastructure via air interface.

The aim of the project is the increase of safety and the reduction of congestion. For example, in case in-vehicle sensors detect black ice on the road or the tail end of a traffic jam behind a corner, the direct communication allows a prompt warning of other drivers around. This will help to prevent accidents. All information about traffic jams collected by the vehicles and transmitted into a traffic control centre can help to analyse the overall traffic condition very quick and precise. This is an important basis for measures to improve traffic flow which leads to a reduction of fuel consumption and helps the environment.

The costs for the project SIM-TD add up to 69 Million Euro. The Federal Government of Germany will fund SIM-TD with 38 Million Euro, which is split to 19.8 Million Euro from the Federal Ministry of Economics and Technology and 10,8 Million Euro from the Federal Ministry of Education and Research. The Federal Ministry of Transport, Building and Urban Affairs invests around 8 Million Euro in roadside infrastructure to support the field trial in a real world environment.

The Field Trial will be carried out by German automotive industry, component suppliers, tele-

communication companies and the public authorities of the Federal State of Hesse where the field trial will be located in the greater area of Frankfurt/Main. Six research institutes will support the project from a scientific point of view. The contribution of the industry to the project will be 23 Million Euro. The companies involved are Audi, BMW, Daimler, Ford, Opel und Volkswagen, Bosch und Continental Teves und Deutsche Telekom. The project has started in September 2008.

Research project AKTIV

The acronym 'AKTIV' stands for a German research initiative called „Adaptive and Cooperative Technologies for the Intelligent Traffic". This German project brings 29 partners together: Automobile manufacturers and suppliers, electronic, telecommunication and software companies as well as research institutions. The four-year cooperation will continue through 2010.

With the goal of improving both traffic safety and traffic flow in the future, the partners are working together to design, develop, and evaluate novel driver assistance systems, knowledge and information technologies and find solutions for efficient traffic management and C2C and C2I communication for future cooperative vehicle applications.

Basically three large subprojects can be identified within the research initiative Aktiv:

The project AKTIV-AS (Active Safety) deals with the development of driver assistance systems with a main focus on safety relevant applications. Within the project AKTIV-VM (Traffic Management) technologies are developed, which will contribute to improve the performance of the road network. The project CoCar aims at the development of cellular mobile communication technologies for cooperative vehicle applications (C2C and C2I). The subprojects are described in more detail below:

- Project Active Safety (AKTIV-AS)

  The vision of automotive research efforts in the long-term is the assisted and conducted safe driving including numerous support functions for the driver. The major objective of the AKTIV-AS project is to take out research on applications for active safety based on the promising results of the previous research initiative INVENT. Therefore prototypes for different left open challenges, such as emergency braking, continuous lateral control, intersection assistance and vulnerable road users, will be developed and tested for real traffic situations. The basis for advanced driver assistance systems is a robust and reliable environment perception and interpretation, which will even support the overloaded and inattentive driver. Missing or inappropriate actions will be detected and compensating measures will be taken by the system. These driver assistance systems shall be introduced into the market in a medium-term timeframe.

  Research is performed within the five AKTIV-AS subprojects:

  - Active Hazard Braking
  - Integrated Lateral Assistance
  - Intersection Assistance
  - Pedestrian and Cyclist Safety
  - Driver Awareness and Safety

- Project Traffic Management (AKTIV-VM):

  The interaction of intelligent vehicle systems and intelligent infrastructure units is the objective of the AKTIV-VM project. This novel kind of team work will create new modes of co-operation between automotive industry, road network operators and the ICT sector. But "Cooperation in traffic" also means a stronger interaction of technical processes which will be enabled by the use of new technologies, software and new communication media.

  The six AKTIV-VM applications combine traffic and information centres, road-side infrastructure and intelligent vehicles in a novel manner:

  - Network Optimizer
  - Virtual Traffic Guidance System
  - Cooperative Traffic Signal
  - Adaptive Navigation
  - Situation-Responsive Driving
  - Information Platform

- **Project Cooperative Cars** (CoCar)

  The CoCar project has already been accomplished. It aimed at taking out basic research in the field of Car-to-Car (C2C) and Car-to-Infrastructure (C2I) communication for future cooperative vehicle applications using cellular mobile communication technologies. Five partners from the telecommunication- and automotive industry developed platform independent communication protocols and innovative system components. They have been prototyped, implemented and validated in selected applications. Innovation perspectives and potential future network enhancement of cellular systems for support-

ing cooperative, intelligent vehicles have been identified and demonstrated.

European Statement of Principles on the Human Machine Interface (HMI)

Against the background of the "Commission recommendation on safe and efficient in-vehicle information and communications systems: update of the European Statement of Principles on human machine interface" (K(2006) 7125), the eSafety Conference, which was held in Berlin on 5/6 June 2007 (see INTRODUCTION, Results of the German Presidency of the EU Council), addressed the implementation and updating of this recommendation and reached the following conclusions:

- There are several ways for ensuring that the update of the European Statement of Principles is complied with and implemented. It states that voluntary self-commitments by the addressees of this EU recommendation (stakeholders) were, in principle, the preferred option among other possibilities (e.g. regulations, consumer protection requirements).
- Special attention has to be paid to issues relating to the safe integration and use of portable systems (so-called nomadic devices) when implementing the update of the European Statement of Principles.
- Given the need for a level playing field, it is especially important to achieve equal and balanced participation by all stakeholders in the voluntary self-commitments to comply with the update of the European Statement of Principles.
- The principles contained in the update of the European Statement of Principles which address issues relating to the prevention of misuse and manipulation are not sufficient to ensure this on a sustained basis. In addition to the creation of new technical standards that are independent of the European Statement of Principles, driver training and appropriate monitoring activities also have to be taken into account. There is a need for measures to ensure that there is no misuse or manipulation and expressly supported the activities of the European Commission in the field of eSafety.
- Before the European Statement of Principles is updated again against the background of continuing developments in the field of science and technology, it is desirable that extensive experience be gained with the present update of this EU recommendation.
- If the European Statement of Principles is updated again, the issue of its scope should be raised again and addressed in depth, in order to take systems into account that have so far been excluded, if this appears appropriate on the basis of the state of the art.

In September 2008 a meeting of European Commission with Member States representatives made a number of recommendations and requests including the re-activation of the Working Group "Human-Machine-Interaction" (WG HMI) under the eSafety Forum Initiative. The WG HMI will take into account questions raised in the meeting with MS in September 2008 and check whether clarifications in the ESoP and extensions of scope, can be achieved.

Real Time Traffic Information (RTTI)

Against the background of the European objective of halving the number of road fatalities by 2010, the application of ITS technologies is becoming increasingly important. As a result of the measures identifies by the eSafety initiative as having priority and being feasible in the near future, traffic information is to be singled out. Even though many European countries have already done preliminary work here – in some cases quite substantial – and information systems are already in operation, albeit in different shapes and sizes, it is important to identify ways and recommendations for action for future improvement.

The Conference on eSafety (see INTRODUCTION, Results of the German Presidency of the EU Council), which was held within the framework of the German Council Presidency on 5/6 June 2007, addressed the issue of real time traffic information (RTTI) services and analysed it from the angles of availability of services,, user requirements, technological development, universal coverage and accessibility. The following conclusions were reached:

- Traffic information is highly relevant to road safety. Both the users and the players involved in the information chain were calling for further improvements in terms of quality and coverage in order to meet the objectives of improving road safety and to assist the driver in performing his driving task. Realistic and feasible quality standards should be developed jointly, with the involvement of all stakeholders. Provisions of sources, whatever public, private or public / private should be made available in all member states.
- Traffic information services should cover not only the primary networks (e.g. motorways) but also sizeable sections of the secondary networks. To this end, "strate-

gic networks" are to be defined. Here, it is quite conceivable that different quality levels could be applied to the individual network sections.

- The increasing number of traffic messages makes it necessary to transmit traffic information digitally so that it can be automatically processed in an appropriate manner, both during the generation and management of the messages and by the users' receivers. For this purpose, the "Radio Data System - Traffic Message Channel (RDS-TMC)" has been developed, which is already in operation in numerous European countries, albeit with varying degrees of intensity. If the secondary networks are to be included, it might be necessary to change over from analogue radio channels to digital broadcast channels (e.g. DAB, DRM). To ensure universal coverage in conurbations, provision will have to be made for appropriate transmission capacity. Joint implementation strategies should be developed on a Europe-wide basis to facilitate access to this information, which is not based on a specific language. The aim is to create reasonably consistent information services within the European Union.

- In Europe, there are both freely accessible "public" traffic information services and commercial information services, which users can access by paying a fee. From a transport policy perspective, access to safety-related traffic information should be possible world-wide without users having to pay additional costs. Some countries have already categorised safety-related information by way of example. The minimum scope of safety-related traffic information should also be defined on a Europe-wide basis. This will not rule out the possibility of individual countries going beyond this scope when providing freely accessible information.

- Commercial information services have their place alongside freely available traffic information services. The services they offer may go significantly beyond those offered by public information services and cater to the individual needs of customers.

- Member States should, in accordance with the principle of subsidiarity, also make the necessary rules and arrangements for the free provision of safety-related traffic information within the framework of Public-Private Partnerships (PPPs).

- The newly developed systems using Car2Car communication and Car2Infrastructure communication were believed to offer great scope for improving road safety. Accidents are to be prevented by interlinking information from vehicles in the vicinity, and possibly also with roadside infrastructure, and by providing timely information on risks. For this information, which is highly relevant to safety, it is necessary to provide reliable and globally acceptable frequency bands that are not subject to interference from other services. Member States and the European Union should call for and support the efforts for the allocation of reliable Car2Car and Car2Infrastructure frequencies.

- To ensure that traffic information provides greater coverage, it is necessary to open up new information channels. The inclusion of vehicle-generated data (floating car data, floating phone data, etc.), data provided by congestion reporters, emergency call systems, etc. makes it necessary to form public private partnerships, within which it must ensured that this improved data basis can be used by both public and commercial service providers for collective traffic management and individual services respectively. Services have to be created and implemented on a long term basis benefiting from existing and coming telecommunication facilities.

Legal issues of Advanced Driver Assistance Systems (ADAS)

Advanced Driver Assistance Systems (ADAS) are growing more and more important for today's road traffic and they comprise a great potential for improving road safety. The investment already made within ADAS-development and the need to ensure effective cross-border transport and uniform conditions for market access throughout the member states of the European Union, has lead the eSafety Conference (held in Berlin on 5th/6th June 2007) in essence to the following common conclusions valid for the EU on the whole:

- The introduction of ADAS that intervene into driving manoeuvres or influence vehicle operation via driver behaviour raise legal issues with regard to the responsibility of the stakeholders (manufacturers, road users, infrastructure managers). National traffic law systems in Europe take their starting point based mostly on the principles of the Vienna Convention on Road Traffic (especially Articles 8 and 13) and see – starting from the technology available in the past – the entire responsibility with the driver. This responsibility

for driving is thereby accompanied by liability of the vehicle keeper. Legal clarity regarding regulatory framework has therefore been considered a main requirement for successful ADAS-commercialisation.

- The legal systems of the EU-Member States cover those ADAS that do not put the full control of the driver over his vehicle into question. Such systems tend to optimise functions initiated by the driver (e.g. ABS) just as well as systems that only provide information or recommendations (e.g. speed alert) or ADAS that can be overridden or adjusted (e.g. adaptive cruise control).
- The legal systems also cover non-overrideable ADAS without any difficulty that perform within customary vehicle limits (e.g. HGV speed limiters) or intervene in situations which cannot be handled in a timely manner by the driver and at the same time guarantee that the intervention remains in accordance with the will of the driver (e.g. ESP, automatic emergency braking).
- It has therefore been recommended to ensure that within ADAS development full driver's control over his vehicle will not be impaired. This will generally avoid specific liability risks. Here the principles and mechanisms developed within the RESPONSE 3 project can be taken as a basis in order to ensure compliance with this requirement. This can help to minimise technological development risks and thereby reduce the liability risk. The observation of functional performance of intervening ADAS in the field – for instance within regular vehicle inspections or product observation – can further contribute to the minimisation of liability risks. The clarification of the understanding of vehicle "controllability" from the Vienna Convention on Road Traffic can lead to further legal certainty and will help to ensure comprehensive cross-border road traffic.
- The eSafety Conference is opposed to ADAS that intervene into driving against the will of a driver still able to perform the driving task. Such ADAS would have legal implications that cannot be predicted at present. Should such ADAS yet be considered, the regulatory framework will have to be fashioned in a way that legal certainty is guaranteed. This will also apply to systems that trigger specific driving functions beyond mere driver information on the basis of telematics (by means of communication with the vehicle).

eSecurity

In the world of transport and traffic, electronic systems are of greater importance than in earlier times. The systems lead to an upgrade in comfort, environmental protection and – above all – road safety. On the one hand electronics and software in vehicles increase the safety of the road users but on the other hand new chances for misuse, manipulation and attacks are born. Consequently it is necessary to protect electronic systems against new risks and design them in a legally permissible way. This mechanism is called "eSecurity" – taken from the terms "electronic" and "secure". The issue of eSecurity is thereby twofold: Risks for eSecurity exist to certain extent in today's cars which becomes evident in prospect of possibilities for manipulation and misuse (e.g. activation of TV-, DVD- or Internet-functionalities for speeds beyond walking speed, unauthorised power enhancement, unauthorised mileage adjustment, etc.). However substantial risks potentially arise within the future field of Cooperative Systems, such as Car-to-Car and Car-to-Infrastructure communication technologies. The risks in this field can only roughly be estimated due to so far foreseeable system-design. This estimation will then necessarily lead to the conclusion that such future systems will require a so far unprecedented security concept. In future this will be the main field of work on this important issue.

At the eSafety conference in Berlin held on the 5th/6th June 2007 (see INTRODUCTION, Results of the German Presidency of the EU Council) the participants agreed that eSecurity is an important issue which must be taken care of. In particular in the development phase, security mechanisms must be installed before new electronic systems are launched. This issue was also identified in the eSafety Initiative and therefore a corresponding eSecurity Working Group has been installed. The working group will present the first results in the course of 2009.

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