# European cooperation in road safety research

*Contribution to the 3rd ADAC/BASt Symposium 'Driving Safely in Europe', Baden-Baden, Germany, June 11-12, 1997*

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# Report documentation

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# Summary

The need for European cooperation in safety research is discussed by comparing road-safety levels of the countries of the European Union (EU) with each other; and the EU with that of the USA, Australia, and Japan. The total socio-economic costs of the lack of road safety in the EU amounts to 162 billion ECU annually, more than the EU-budget itself. European cooperation in innovative safety research and Europe-wide shared views on validated road safety measures can contribute to the effectiveness of national and European road safety policies. FERSI (now representing fourteen European national institutes) was established in 1991 with the aim of promoting European cooperation in road safety research. Also to sustain the EU road safety R&D and policy matters, and to foster a European exchange of safety knowledge and researchers. An overview of the cooperative activities of FERSI with respect to the 4th Research Framework Programme of the EU and other by the EU-commissioned research is given. A resume of the mission of FERSI in the preparation of the 5th Research Framework Programme, in which a widening of cooperation with the research centres in the CEE-countries is foreseen, is also presented. Moreover, the possible contribution of cooperative research to an enhanced road safety policy of the EU is highlighted. Lastly, apart from legal EU-measures, it is argued that a European knowledge exchange, by establishing research based 'best practices' and by EU-conferences for road transport and safety professionals (comparable to the TRB-conference in the USA), will harmonise road infrastructure and transport, and enhance road safety throughout Europe.

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# 1. The importance of the safety problem

The number of road fatalities in the fifteen countries of the European Union (EU) in 1995 was about 45,000. The seriously and slightly injured persons are differently defined in the national registrations and are also greatly underreported. The total registered number of seriously injured persons in the EU is about 350,000, and of slightly injured persons the number is about 1,200,000. Correcting for the underreporting (OECD-IRTAD, 1994) *the actual total of seriously and slightly injured persons was about 3.5 million in 1995 in the EU.* Material damage-only accidents (MDO) are even more underreported. For European countries, where insurance claimed MDO accidents are compared with national road accident registers, the underreporting is at least 75%. This percentage is even higher when non-claimed MDO accidents that need vehicle reparations are included. For 1995 the *total of actual MDO accidents probably exceeded 60 million in the EU.* On the average it means that each motor vehicle was involved in at least one MDO accident every three years.
Over the years there has been a downward trend in registered fatalities, which expresses a trend in the severity reduction of accidents. In the safer EU-countries the number of slightly injured are hardly decreasing over time. Most likely the actual number of MDO accidents is increasing, although less than the annual kilometrage.
In all EU countries traffic accidents are the main cause of fatality for the age group of 16 to 24 year. Due to the young average age of road fatalities *the expected number of life years lost (YLL) in road accidents is higher than for any other type of accident or disease.*

The total socio-economic costs of (the lack of) road safety in the EU are 160 billion ECU in 1995 (ETSC, 1997). This estimate includes economic losses and a value of human life based on the 'willingness to pay' method.
The break down of these socio-economic costs is (in rounded-off figures):

| | | |
|---|---|---|
| Economic costs fatalities | 20 | |
| Human costs fatalities | 30 | |
| Total costs fatalities | | 50 Billion ECU |
| Economic costs reported injured persons | 20 | |
| Economic costs unreported injured persons | 10 | |
| Human costs serious injuries | 30 | |
| Total costs injured persons | | 60 Billion ECU |
| Costs damage-only accidents (MDO) | | 50 Billion ECU |
| **Total socio-economic costs all EU-accidents** | | **160 Billion ECU** |

Table 1 *The total socio-economic costs (in rounded off figures) of (the lack of) road safety in the EU in 1995, including economic losses and a value of human life based on the willingness to pay method.*

In the ETSC report it is concluded that 97% of all socio economic costs of fatalities and casualties in passenger transport is caused by road transport (the other 3% for rail, air and sea transport). Moreover the report shows that

*it is justified to invest 3 6 million ECU per fatality for the improvement of road safety* in order to prevent an otherwise expected road fatality and the injury and MDO accidents, which in average are concurrently occurring per fatality.

Only fatalities (corrected for the thirty-day definition) can be made comparable by risk figures, such as fatality rates (fatalities per motorvehicle kilometre), because national figures for injured persons and accidents differ because of registration definitions and marked differences in reporting coverage. The figure below contains the relevant comparison data for the fifteen EU-countries and bordering countries in Europe for 1994 as the latest year with available kilometrage for nearly all countries. For comparison of the road safety level in the EU with the major industrialised countries on other continents, the same rates are given for Australia, Japan, USA, and the EU.

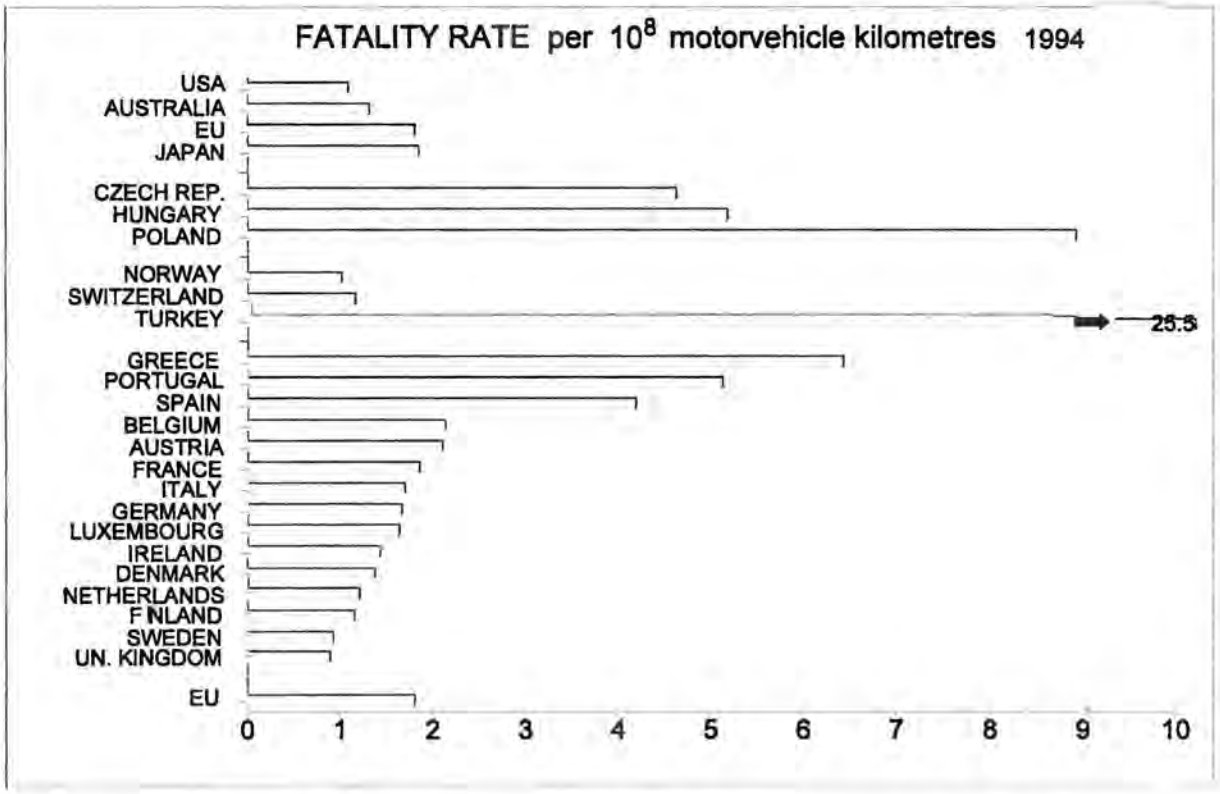


Figure 1. *Fatality rates per 100 million motor vehicle kilometres for all countries in 1994.*

From the above figure one sees that the road safety levels within the EU differ by a factor 7, while for the EU as a whole the road safety level has been and still is worse than for the USA and Australia. Japan and the EU now have similar road safety levels, but the share of motorised two-wheelers in Japan is larger. For cars the risk level in Japan is lower than in the EU.

# 2. Road safety research in Europe

The Forum of European Road Safety Research Institutes (FERSI) was created in 1991 to bring together these organisations to provide a common focus for research on a European level. This Forum is ideally placed both to bring together the results and experience from these national programmes, and to use this knowledge to assess research needs and undertake research directly for the European Commission. FERSI's purpose is to:

- provide a forum for developing collaborative research projects aimed at producing solutions to common safety problems within several EU countries;
- provide support to the European Commission in defining the research needs within Europe;
- encourage the exchange of good practice and research knowledge between countries;
- encourage the closer cooperation, and where appropriate, the exchange of researchers between countries.

FERSI membership now includes fourteen countries, mainly from the EU, but still missing due to the absence of a national institute are: Greece, Spain, Italy and Luxembourg. Norway and Switzerland are represented, while recently the coverage of FERSI will be expanded by including central and eastern European countries of which the Czech Republic and Hungary are the first to become members. In those European countries that are not yet members, the constraint has been the difficulty in finding single research organisations that provide a primary focus for national research. FERSI believes that a European road safety research programme should address the following objectives:

- to address all the key areas for casualty reduction (education enforcement and road and vehicle engineering);
- to seek both short term and long term solutions;
- to provide solutions that embrace the differences between European countries in both their problems and the potential effectiveness and acceptability of the solutions;
- to implement common standards where these are appropriate, but also more generally to identify and encourage transfer of good practice between countries to maximise the scope for reducing casualties throughout Europe;
- to take account of the key role of road user behaviour in developing and implementing solutions;
- to achieve solutions that command broad support from public bodies, transport industry and road users alike.

It has for long been recognised that road safety can be influenced through measures aimed at either the road, the vehicle, or the road user. Increasingly it is being recognised that solutions in one area also effect behaviour in other parts of the system. More recently solutions have been sought that aim to capitalise on these interactions to increase the potential for casualty reduction. The SATRE opinion surveys conducted by FERSI showed the variation in attitudes between European countries. This means that the potential effectiveness and acceptance of measures may differ significantly between countries, and the final choice of measures aimed primarily at changing attitudes and behaviour may best be decided by those countries.

Nevertheless, knowledge of how road users will respond, is so important to most safety measures that research aimed at improving our understanding of these responses is important to all countries, and is potentially of great benefit to the EU to encourage effective road safety measures. Important focal points for behavioural change are: road design, telematics, enforcement regimes, and public information campaigns. Firmer evidence of the optimum way to design all these is still needed. The value of research lies in the systematic application of well collected data to provide sufficient understanding of each element of the road safety problem to be able to devise effective solutions and promote their implementation. This process involves data collection, research, solutions, and implementation on a range of different timescales. The need for speedy short-term responses to some problems should be balanced by maintaining a well justified programme of longer term research, from which solutions can be developed. The EU is well placed to develop such a programme.

The framework programmes are designed to provide such a core programme. The Safety theme of the Road Transport element of the 4th Framework addresses many of the areas described above upon which current research is focused. Projects provided by contracts with participating institutes of FERSI include:

- common crash injury databases (STAIRS);
- speed management requirements and the role of speed control devices (MASTER);
- consistent standards for road design (SAFESTAR) and work zones (ARROWS);
- safety in urban areas (DUMAS and ADONIS);
- secondary safety research (COMPATIBILITY).

The areas of driver behaviour research, and measures to improve the safety of vulnerable road users have been relegated to the third Call, with the likelihood of participating institutes of FERSI. The role of new technology is a topic of study in the 3rd and 4th Frameworks. A lot of research has been directed towards looking for applications for developed or potential technologies. Very little research has been done on technology from the viewpoint of existing safety problems and identifying what 'technology' is needed to develop new solutions. The broader trends and problems that might arise from technological changes introduced for other reasons, should also be monitored. Safety solutions need to be sought and implemented as a response to a pattern of continuing social and economic change. These general trends, in so far as they affect safety solutions, should be better understood. The different development of these trends in different countries will be important in assessing the scope for European, in addition to national, initiatives.

Current national research programmes in each country show what they each consider to be the current research priorities. There is substantial similarity in these, but also significant differences relating to some of the cultural and social differences. Many countries have set national casualty reduction targets and suggested programmes to achieve them. In addition a few countries have defined longer term 'Foresight' programmes to aid their programming. The focus of a European programme however allows value to be added by considering where there is scope for common standards and for collaborative research to establish and promote best practice across Europe. It can provide the impetus for combined effort towards common solutions,

and for the more general exchange of information and experience. To achieve these objectives it needs to determine how best to combine national approaches which may well have differing goals. The EU programme provides the funding to produce this added value, and through organisations such as FERSI, can provide the joint expertise and collaboration necessary. This is not only to provide European solutions but also to exploit the results to ensure they are consistent with the needs of the individual countries from which the researchers originate. This emphasis on generating results with a European focus, but acceptable to national needs, should be an essential element of all EU funded projects. The justification for a European research programme should relate to the overall potential for casualty reduction within the EU. A European casualty reduction target could provide a useful public focus for this programme, and a gauge by which its success can be measured.

To ensure that solutions are derived from a European programme which will command broad support from countries with differing problems and priorities, it is necessary not only to involve representatives from those countries in collaborative research, but also to expose the research to debate amongst experts. Regular European-wide conferences focusing on the results of the projects within the European programmes, alongside reports of national research projects, would provide the opportunity for this debate. The annual FERSI/FERHL conferences could be developed to provide this forum. It would be useful to encourage dialogue with the end users of research: public authorities, industry, and the public; through representational groups, as part of this debate. FERSI also works closely with ETSC and ERSF in providing European wide views on road safety issues. FERSI is currently collaborating with ERSF in several research projects subsidised by DG VII. Many FERSI institutes currently provide representatives to the ETSC working groups who actively contribute to the reports of the ETSC. FERSI and FEHRL (Forum of European Highway Research Laboratories) want to intensify their collaboration in order to establish a European (Road) Transport Research Board. If sustained by the EC (DG VII) in a substantial way, such a European (Road) Transport Research Board could foster the European cooperation in road transport, infrastructure and safety research. It could (bi-)annually organise a European conference on road transport research (as European counterpart of the annual TRB-conferences), in order to facilitate the transfer of research knowledge and the harmonisation of applications by professionals and road authorities throughout Europe.

# 3. Reconsidering the priorities

In the EU 80% of the passenger transport is by passenger cars and 8% by coaches and buses. The non-road modes account for only 12% of the passenger transport and for 30% of the freight transport within the EU. As stated, 97% of the socio-economic costs of the lack of safety in passenger transport is due to the road accidents. Of all fatalities in passenger transport within the EU nearly 96% is due to road transport; for injuries this percentage is 98%. Moreover, the road risk level in the EU as a whole is higher than in the USA or Australia and for comparable traffic also in Japan. The possible role of the EU in relation to safety of (passenger) transport, clearly asks for a higher priority for road safety in policy making as well as in the EU expenditures for R&D on road safety and for the road safety aspects of multimodal transport and transport telematics. Although the subsidiarity principle constrains the EU in legal matters on road safety, up to now the road safety measures of the EU and its nations do not ensure: "that wherever people travel on Europe's roads, they will find that vehicles are as safe as possible; that the roads themselves are easy and safe to use; and that there are clear, well-enforced rules governing dangerous and anti-social behaviour by road users" (Kinnock, 1996).

Of the 1050 million ECU on transport related R&D in the 4th Framework Programme of the EU, the share of dedicated road transport research is less than 10% and less than 2% for R&D dedicated to road safety. This is in sharp contrast to the shares of road fatalities and road accident costs in the totals of fatalities and accident costs of all passenger transport of the EU. Although some other R&D domains may contribute to road safety as well, there are hardly provisions to ensure that this actually will be the case. Notably the transport telematics projects are potentially important for road safety, but up to now only a few projects have shown a demonstrable positive effect on road safety. Some other telematics projects, when actually applied, even may be detrimental to road safety.

The efforts of the EU to promote collective and intermodal passenger transport are most welcomed, since the non-road transport modes are much safer. This is expressed in the Green Paper *Citizens' Network* for more efficient en attractive public transport. 70% of the investments in the fourteen priority projects for the *trans-European transport network* are for rail; the *research task forces* on intermodal transport and railway systems of the future. It would mean a great success, if within twenty years time this would result in a doubling of passenger transport by the other modes. However, in view also of the expected growth in road transport, it would only mean a shift from 12% to 16% of the non-road passenger transport in the EU. Intermodal transport and other modes of transport can by no means solve the road safety and congestion problems in the EU. This is notwithstanding its necessary partial (but probably rather minor) contribution to the reduction of these problems. Moreover, public passenger transport generally asks for pre- and post transport by the most vulnerable modes of road transport. Therefore, probably many multimodal trips are more risky than door-to-door trips by private car. The safety of multimodal trips and the safety optimisation of its modal links and transfer points with high risk are largely unexplored research areas. These deserve a higher

priority in the RTD-programme in view of the promotion of intermodal transport by the EU.

The Green Paper on *Fair and Efficient Pricing in Transport* promotes an EU policy for the internalisation of external costs. If strictly applied it would relatively increase the price for the use of motorways and of rail and air transport, because these are the domains with the largest shares of external costs (for rail even less than 50% is covered by the ticket). It could mean that the safest part of road transport and the safer transport modes would become relatively much more expensive, which only could influence the overall safety of passenger transport in a negative way. For reasons of social fairness this may not be realised for public transport modes, but even then a road pricing of motorways will shift the road traffic to main rural roads that have a manifold higher risk. The safety impacts of changed pricing policies, therefore, ought to become an important new aspect of the RTD-programme of the EU.

Thus there are plenty of reasons to reconsider the priority setting, the consistency, and effectiveness of the activities of the EU in relation to the improvement of transport safety. A political target setting of an achievable 20,000 less road fatalities from 1995 to 2010 in the EU of the fifteen countries, could be one of the means to ensure the necessary priorities for effective actions. The Treaty of Maastricht explicitly requires that the Common Transport Policy should include measures to promote transport safety. It must be deduced that this especially implies measures to improve road safety and the road safety aspects of multimodal transport. Although the EU powers are not exclusive, the EU objective could be rephrased as: "Ensuring an almost equal and optimal level of safety for road users wherever people travel on the roads in the EU".

Legal measures of the EU are urged if value is added above national legal measures. However, differences in legal measures already contribute to less road safety because of the promoted and actual fast growing kilometrage of trans-border road traffic within the EU. Some crude estimates indicate that already 12% of the road fatalities occur with involvement of road users from abroad. Harmonisation of road traffic measures and rules within the EU, therefore, must be viewed as a matter of added value. Optimal EU measures for road safety could be selected by comparing nations in search of the best practices. The needed harmonisation of legal measures, traffic rules and enforcement practices should be based on researched optimisation. Research on the safety effects of differences in national traffic laws and enforcement as well as the feasibility of their optimisation on a European level have hardly been subjects of research commissioned by the EU. Apart from legal measures there is the possibility of harmonisation by promoting the best practices. As in the states of the USA, this is best achieved by influencing the professional community of road engineering, road authorities and officials (including those of police, road user and driver education organisations). Authoritative research conferences for the dissemination of road safety know-how on the EU level, issuing of guidelines and other kinds of concerted action for the promotion of best practices, similar to the TRB-activities in the USA, are almost absent in the EU.

The future Road Transport Research, Technological Development and Demonstration (RTD) activities of the EU with respect to *Sustainable Mobility* and the *Enhanced Efficiency* of road transport as well as the RTD

with respect to *Infrastructure* and motor vehicle research are in many respects closely related to the planned research for *Safety and Human Aspects*. The structure of the road network, the road and crossing designs and technological vehicle and roadside equipment have substantial influence upon road user behaviour. This is fully acknowledged in the policies for sustainable-safe road traffic in the Netherlands, 'the zero vision' in Sweden and the disaggregated safety targets in the UK as well as partially in some other national road safety policies of EU countries. Vehicle behaviour and layout of roads and crossings are the stimuli to which road users' behaviours respond and determine for a large part the predictability of the road behaviour of other road users. These generic stimuli from infrastructure and vehicle dynamics should minimise the chances of human errors. Dedicated research on the road safety aspects of the RTD on road transport, road infrastructure, road vehicles, road transport telematics and multi-modal transport that partially uses the road, should therefore become a substantial and integral part of the fifth RTD programme.

A strategy for reducing exposure to road risk must be developed. The level of road safety is determined by the product of risk and exposure. Reducing the exposure to road risk improves road safety as much as lowering the road risk itself. Research into road design and the structure of road networks that minimises differences between roads with similar functions as well as research for a network use that will minimise differences in speeds, directions and masses of road user vehicles, will lead to an enhanced predictability of oncoming traffic situations and behaviours of other road users. Similar functions ideally lead to a few uniform and well recognisable road categories with identical traffic rules in Europe. It would contribute to reduced exposure to risk. It should not only be the basis for a policy that structurally improves road safety by eliminating most of the conflict possibilities with possible serious and fatal outcomes, but it also would contribute very much to an enhanced efficiency of road traffic. Research on how the predicted growth of road traffic and the needed reduction of exposure to risk can be combined, is almost completely absent and has up to now no place in the RTD programme of the EU. An important obstacle for progress in road safety research is the lack of relevant disaggregated exposure data. Differentiated exposure data between roads, road user types, and other relevant categorisations are largely absent. Exposure data for pedestrians, cyclists and mopeds are seldom available. It is not only for this reason that the knowledge of the road safety for many categories of road users (e.g. children and the elderly) is hampered, but also because of the selectively larger underreporting of accidents with seriously and slightly injured persons of non-motorised road users (cyclists and pedestrians). Fruitful road safety research for all road users would be very much sustained if the priority for improved and harmonised data on national and European level could be obtained. How this can be achieved is in itself a strategic research topic that should address all European nations.

Relevant research for the most effective ways of risk reduction is still mainly found in the traditional domains of road safety research directed to the safety of vehicles, road designs, road user behaviour, traffic rules and their enforcement, as well as the optimisation of first aid and medical services. New prospects are nowadays found in the application of telematics for these domains and in the integration of these domains by strategies of road authorities for an advanced road safety management system. A FERSI-inquiry revealed that the road safety effects of technological changes in road

transport, advanced traffic control and management systems, and safety effects of demographic and cultural changes (lifestyle) ought to become high priority topics of the RTD-programme of the EU. Its problems exceed or can not be solved on the national level.

An important topic on the European level is the exploitation of national research and safety measures for the benefit of other countries. It concerns a serious problem on three levels.
Firstly there is no organisational structure that facilitates national cooperation. Even if several EU-countries have the same type of problem priority there is no mechanism that promotes their research cooperation.
Secondly, plenty of research findings and proven safety measures in one or some countries are either ignored or not applied in other EU-countries. Moreover, similar research in different EU-countries with partially overlapping or partially inconclusive results are not scrutinised or combined on a European level. There are hardly funds available for meta-analysis of different national research results and insufficient structural means for the analysis of the applicability of national safety measures on a European level. Some expenditures however can be covered by the COST-programme.
Thirdly, the research as well as the application of know-how by road and road traffic professionals is mainly nationally organised, while there is no authoritative European organisation similar to the TRB in the USA, that sustains research coordination and the exchange of know-how between professionals of the nations in the EU.
It is felt that on all three levels there are opportunities for action on the EU-level that are of benefit for all EU-nations and the improvement of road safety.

# 4. Recommendations for a 5th RTD-programme

Above all it is recommended to enlarge manifoldly the share of funds for research, dissemination and exploitation of research results dedicated to road safety in the RTD-programme and in the legal and other applied transport activities of the EU. The total road accident costs (over 160 billion ECU, 97% of all transport accidents costs) outweigh the costs for congestion and environmental problems. The twenty million ECU for dedicated road safety research in the 4th R&D programme and the less than eight million ECU for applied road safety within the Transport Department of the EU do not reflect in an appropriate way the priority that should be given to road safety. Apart from a higher priority for dedicated road safety research, greater emphasis should be placed on the provisions which guarantee that research on transport telematics, intermodal transport and transport economics are actually contributing to road safety. The specifications of any road research project should be explicit with regard to influences on road safety.

Secondly it is recommended to establish and subsidise a European (Road) Transport Research Board (ETRB) for the collaboration of national safety research and the guarantee of successful transfer of know-how and technology. FERHL and FERSI, as European road research organisations, are prepared to become co-founders of such an ETRB, which could be in the first phase directed to road transport in a similar way as the TRB in the USA. The TRB of the USA started in 1926 as a road transport organisation, expanded in 1976 to the TRB of today covering all transport modes.
The TRB has a staff of 120 employees and is mainly financed by the Federal Highway Administration, but its activities are undertaken in agreement with the different state authorities within the USA. A European TRB should become a similar authoritative European organisation, that sustains research coordination and the exchange of know-how between professionals of the nations in the EU. One of the tasks of an ETRB should be the organisation of an authoritative research conference on (road) transport on a (bi-)annual basis for dissemination of research results among road researchers and exchange of know-how among road professionals in the EU (and CEEC). Another task of an ETRB could be the sustainment of the EC in planning, execution and exploitation of (road) transport and (road) safety research as well as to organise collaboration between the national transport and safety research institutes on EU-funded as well as nationally funded research.

Thirdly it is recommended that the legal and other applied road safety actions of the EU exploit the possibilities of validation research and meta-analysis of national evaluations on safety measures that have not, or differently, been applied in all EU-countries. Their application on a EU level could contribute to a marked improvement of the road safety level in the EU, but it asks for additional validation research, feasibility studies before a EU-wide application can be undertaken and for meta-analysis of differing national evaluation and research results.

The fourth recommendation concerns the improvement of the European accident database (CARE) and the opening of access to that database for road safety research institutes. It is recommended to plan the improvement of the CARE-database in close cooperation with FERSI, since it will be mainly the national road safety research institutes of the EU that will

become the chief users of CARE. A further recommendation in this respect is to research the extend of the national underreporting of accidents in the CARE-database for different categories of accidents (at least for road types, age and other relevant road user categories, such as pedestrian or vehicle type).

The last general recommendation concerns the evaluation of current road safety problems, forecasting their expected developments and analysis of common aspects in the policies for 'the zero vision' in Sweden, sustainable - safe road traffic in the Netherlands, and the disaggregated safety targets in the UK, as well as the effectiveness of existing national road safety policies of the all EU-countries. This in order to study the feasibility of the formulation of an effective road safety policy on the EU-level that is sustained by the nations of the EU.

The following priorities for research, development and demonstration projects within the general, strategic and specified key issues of the fifth Framework Programme are based on an extensive inquiry among the FERSI-members and thus reflect the research needs of the research community in Europe.

*General and strategic research for road safety*

1. Research on the optimal measurement of exposure and the establishment of a European exposure database with comparable exposure measures for different categories, in order to be able to determine disaggregated risks and to be able to evaluate and compare different national measures.

2. Research on to what potential extent the problems of road traffic (congestion, safety, environment) with a foreseen road traffic growth can be reduced by realistic expansions of non-road transport and intermodal transport and by application of transport telematics.

3. Research for a better grounded estimation of the socio-economic accident costs by the application of the willingness to pay method in for all EU countries as well as for the socio-economic accident costs for other modes in the EU using the same method.

4. Research on the expected effects on road safety of road pricing (especially if only on motorways) and of varying road transport taxes.

5. Research on to what extend trans-border traffic and the kilometrage driven by foreign drivers influences national road safety levels in the EU and on measures for foreign drivers.

6. Research on how growth of road traffic can be combined with reduction of exposure to risk.

7. Research on the road safety effects of technological changes: vehicle telematics, vehicle and traffic control and management systems, ATT/RTI applications, advanced guidance and navigation systems, car black boxes, and technological innovations for car energy systems (e g. electric cars). Also on the effects on road behaviour of non-equipped road users in response to change as well on safety effects of future car

use as concurrent cultural (digitalization, lifestyle) and demographic changes.

*Integrated transport chains and road safety*

8. Research on the safety of multi-modal passenger trips and the risks of the separate modal-links and transfer points, including the pre- and post public transport risks.

9. Research on the safety effects of modal changes and modal split concerning freight transport and distribution as well as the possible contribution to safety and efficiency of advanced underground freight transport systems.

*Urban transport and road safety*

10. Research on safety assessment (possibly as integral part of transport efficiency and environmental assessment) of: industrial development (incl. freight and home-work transport and freight distribution structure), town planning, planning of urban public transport, planning of traffic calming areas, car restricted areas and parking facilities (with special attention for exposure to risk of walking and cycling as well as children and elderly in agglomerations).

11. Research on methods for acceptance and feasibility as well as policies for the successful implementation of safety driven restructuring plans in urban environments.

*Enhanced efficiency of road transport and road safety*

12. Research for integrating safety assessment with policies for enhanced efficiency of road transport, such as congestion control, demand management, and traffic management policies.

13. Scenario research on EU-wide telematic traffic management and its expected effects on road safety. Also research on what conditions guarantee a safe future implementation of large scale telematic transport systems and research on what can be learned in this respect from the safety effects of implemented telematic systems on some smaller scale.

14. Research on safety, environmental, infrastructural and fiscal perspectives for the development of traffic and transport trunks in Europe in the future.

15. Research and development on telematics that are specific aimed at improved road safety (e g. intelligent speed adaptor, telematics preventing the most often occurring types of accidents) and the cost-benefit of such telematic innovations.

16. Research on the safety effects of modern electronic communication devices in cars and trucks and the feasibility of positive safety effects of their future development.

17. Research and development for software, simulation, and multimedia packages with focus on safety problem analysis and development of solutions.

18. Safety research on improved compatibility of cars and trucks. Also on truck and car designs with improved passive safety for vulnerable road users as well as basic research for the feasibility of simulation standards for passive safety of cars, the improvement of simulations of biomechanics and the development of an appropriate child dummy.

19. Safety research on improvements in mechanical design and maintenance of cars (e.g. preventive electronic defect detections replacing annual vehicle inspections).

*Road safety and human aspects*

20. Human factor research on man-machine interaction in view of intelligent guidance and navigation systems and other in-car operating telematic transport systems.

21. Research on frequent human errors in reactive traffic behaviour aimed at know-how for the design of road infrastructure and vehicles that will minimise the chances of human errors.

22. Research on the efficiency of safety campaigns and effectiveness of strategies for traffic behaviour modification, as well as behavioural and attitudinal studies with regard to road safety measures.

23. Research on automatic systems for the monitoring of driver status and their potential in preventing accidents caused by impairment of skills and driving performances as well as on the effectiveness of alternative measures for the prevention of accidents caused by (il)legal drugs and fatigue.

24. Studies on driver behaviour in response to change and on the features of safety measures that are predictive for adverse risk compensation behaviour of road users.

25. Acceptance and feasibility studies with respect to advanced in-car and other electronic devices for automatic enforcement.

*Sustainability of road transport and road safety*

26. Research on the effects of land use, industrial development (incl. road transport of dangerous goods), and traffic infrastructure planning on road safety. Also the integration of their road safety and environmental assessments in rural areas (see also urban transport and road safety) as well as for tourist planning regarding traffic safety and environmental protection.

27. Research on the relationship between safety and environmental quality (road design, traffic and speed control). Where are synergetic safety and environmental effects of transport innovations (e.g. alternative fuel use of cars such as electric cars) and where are potential conflicting effects (e.g. enlarging the share of motorway traffic).

28. Research on the acceptance and feasibility of safety and environmental oriented restrictions to individual and freight road transport.

*Road infrastructure and road safety*

29. Research on which infrastructure network and road design can accommodate the growth of road traffic and also reduce exposure to risk. Also on which telematics serve the protection of vulnerable road users as well as the efficiency of motor vehicle transport.

30. Research on infrastructural road design and vehicle dynamics which minimise the probability of human errors in traffic behaviour.

31. Research on underground and other advanced alternative ways of freight transport (long distance) and urban freight distribution and its contribution to safety, economy and environmental quality.

32. Research on the relationship between infrastructure (design and maintenance) and road safety. This with focus on the safety evaluation (safety effect studies of infrastructure plans and safety audits).

This exemplifies one of the mission elements of FERSI: providing support to the European Commission in defining the research needs within Europe. The proposed EU actions related to road safety and research with possible added value for the future are in line with the objectives of the EU policy on RTD. The topics formulated are coherent and sustain each other in the potential contribution of a marked enhancement of the road safety in the EU. The proposed research does not only reflect the research needs of the European research community on road safety, represented by FERSI. Since the FERSI members are operating closely in touch with - mainly performing research for - their national road authorities, the proposals are also consistent with the national research needs of their Transport Ministries. Also great care is taken to formulate proposals that ask for research that exceeds the national level.

# Literature

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