SAFETY OF RURAL ROADS IN GERMANY

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ABSTRACT

Road safety has improved considerably in Germany in the past four decades. But rural roads are still the main problem. 61% of the fatalities occur on rural roads and the risk of being involved in a fatal accident on rural roads is more than four times higher than on motorways.

The main problems on rural roads are driving accidents, leaving the carriageway and collisions with oncoming traffic. 30% of the fatalities occur in a collision with trees and nearly 20% of all killed persons on rural roads are young male drivers between 18 and 24 years.

There is an extensive range of measures responding to these problems and improving road safety on rural roads in Germany. The road safety management system comprises black spot management, network safety management, road safety inspections and road safety audits. This enables road authorities to identify the road sections where safety improvement measures are expected to have the best efficiency.

A large-scale test investigates the effects of overtaking lanes and speed surveillance over long distance. First results show that speed monitoring measures are able to improve road safety. Actually a reviewing process of the guidelines for the design of rural roads is running, based on the “self-explaining road” - concept.

The paper gives detailed information about accident data on rural roads, an overview about the German safety management system and presents some specific measures improving road safety on rural roads.

Keywords: rural roads, road safety

1 INTRODUCTION

Road safety has improved considerably in Germany in the past four decades. The number of road fatalities decreased from more than 21,000 in 1970 to less than 4,500 in 2008, although traffic density had tripled during that period. But regarding the types of roads the improvements were different. While the risk being involved in an accident on motorways decreased strongly, the improvements on rural roads were not so pronounced. Actually, in Germany most fatal road accidents (60%) occur on rural roads. The fatality rate is more than four times higher than on motorways. Consequently, road safety improvements on rural roads are a major issue.

Deepened analyses of accident data reveal some key problem areas. First, collisions with trees are a grave problem. Secondly, young drivers continue to be one of the groups with the highest risk.

There is an extensive range of measures to improve road safety on rural roads in Germany. The German road safety management system comprises black spot management, network safety management, road safety inspections and road safety audits. Furthermore there are specific measures to improve safety on rural roads, like overtaking lanes and speed monitoring. Finally a reviewing process of the guidelines for the design of rural roads is running, based on the “self-explaining road” - concept.

2 ACCIDENT DATA ON RURAL ROADS

2.1 Trends of road safety in Germany and Europe

In Germany about 2,294,000 accidents were recorded by the police in 2008, in 1991 there were counted about 2,311,000 accidents.

Figure 1 - Number of accidents in Germany 1991 - 2008 (DESTATIS)

The number of 2.3 million accidents per annum is nearly constant in this period. Contrary to this, the number of personal injury accidents decreased from 385,000 in 1991 to 320,000 in 2008. This is a reduction of 17%. A part of these accidents are fatal accidents. The number of these accidents decreased by 60% from about 10,000 to 4,100 in 2008.

More than 410,000 people were injured or killed in road accidents in 2008. These are about 100,000 casualties less than 1991. Especially the number of fatalities decreased in this period by 60%. In 2008 there were less than 4,500 fatalities. The number of seriously injured persons decreased by 50%.

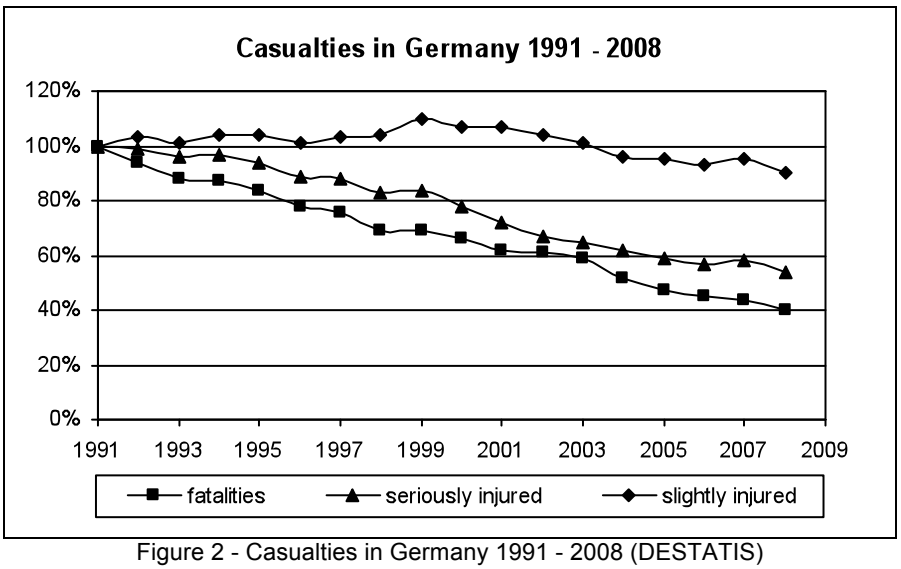

Figure 2 - Casualties in Germany 1991 - 2008 (DESTATIS)

The statistics document a considerable improvement of road safety in the last twenty years in Germany. But a look at other European countries reveals countries with quiet better improvements (see figure 3). The number of personal injury accidents in France for instance was reduced by 50% between 1990 an 2007. On the other hand there are countries with a significant increase of personal injury accidents like Italy (43%).

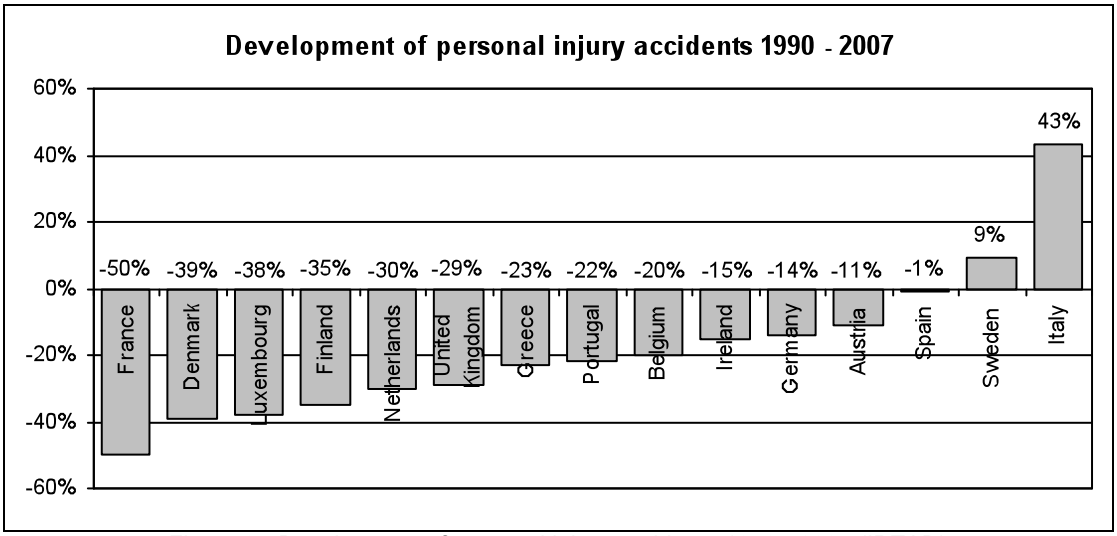

Figure 3 - Development of personal injury accidents 1990 - 2007 (IRTAD)

Figure 4 shows the trend of fatalities. Since 1990 the numbers of killed persons in road accidents were reduced in all European countries (EU 15). This data may differ from national statistics. It is to consider that there are different definitions of slightly and seriously injured and killed persons in road accidents. To compare the national statistics, among each other adjustment factors have to be used. “30-days” definition of fatalities in road accidents is used in the shown statistics.

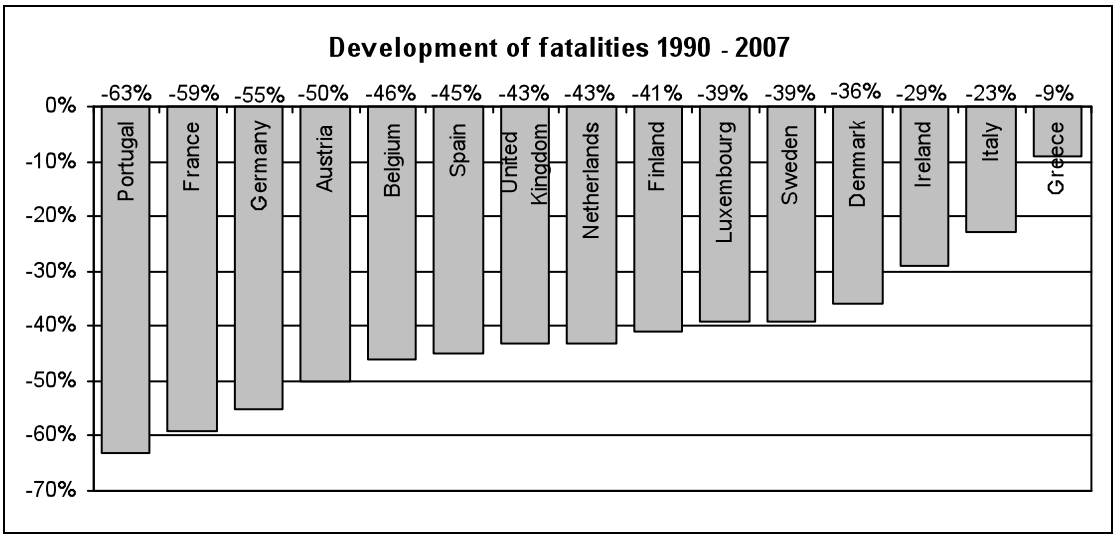

Figure 4 - Development of fatalities 1990 - 2007 (IRTAD)

In summary the development of road accidents and casualties is mainly positive. In the following we will have a closer look on accidents on rural roads.

2.2 Accidents on rural roads

To analyse the accident locations, three areas are distinguished: inside built-up areas, outside built-up areas (rural roads) and motorways. The accident data of 15 European countries show that personal injury accidents mainly occur inside built-up areas. The percentage of these accidents ranges between 50 and 70%. On rural roads we find between 25 and 50% of personal injury accidents.

Looking at the fatalities the result is completely different. Rural roads are clearly the central problem. Between 50 and 75% of the fatalities occur on roads outside built-up areas, only about 30% inside built-up areas.

The data analyses show clearly the need to focus on rural roads in all European countries, to gain further achievement in road safety.

Figure 5 presents the allocation of accidents and casualties in Germany. Accidents are mainly localized inside built-up areas (73%), only 20% occur outside built-up areas. But serious accidents are allocated in a very different way: 60% of fatal accidents occur on rural roads.

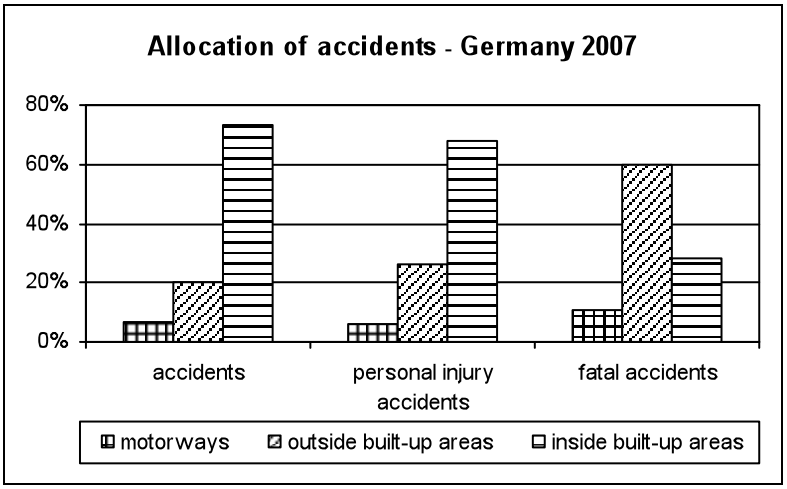

Figure 5 - Allocation of accidents in Germany 2007 (DESTATIS)

Accident rates, taking into account the mileage, describe the risk of being involved in an accident. In Germany the mileage in the three distinguished areas is nearly the same (~230 bn vehicle-km).

Table 1 - Accident rates and casualty rates in Germany 2007 (DESTATIS)

	personal injury accidents	fatal accidents	casualties	fatalities
	[per bn vehicle-km]			
all over	485,3	6,7	630,6	7,2
motorways	96,4	2,5	150,4	2,8
outside built-up areas	359,2	11,5	522,7	12,5
inside built-up areas	959,5	5,4	1167,5	5,6

The risk of being involved in a personal injury accident inside built-up areas is almost three times higher than outside built-up areas. But the risk of being involved in a fatal accident on rural roads is more than twice as high as inside built-up areas and more than four times higher than on motorways.

2.2.1 Type of accidents on rural roads

The type of accident describes the conflict situation which resulted in the accident, i.e. a phase in the traffic situation where the further course of events could no longer be controlled because of improper action or some other cause. It does not describe the actual collision but indicates how the conflict was touched off before this possible collision.
The following seven types of accidents are distinguished in Germany:

1. Driving accident (F)
2. Accident caused by turning off the road (AB)
3. Accident caused by turning into a road or by crossing it (EK)

4. Accident caused by crossing the road (ÜS) - accident was caused by a conflict between a vehicle and a pedestrian on the carriageway

5. Accident involving stationary vehicles (RV)

6. Accident between vehicles moving along in the carriageway (LV)

7. other accident (SO).

Figure 6 shows the personal injury accidents and fatalities on rural roads subdivided by the type of accidents. The figure reveals two main problems. 38% of the personal injury accidents and 50% of the fatalities are caused by driving accidents (F). Driving accidents are accidents caused by driver's losing control of his vehicle, without other road users having contributed to this. Reasons for losing control are inappropriate speed, misjudgement of the course or conditions of the road.

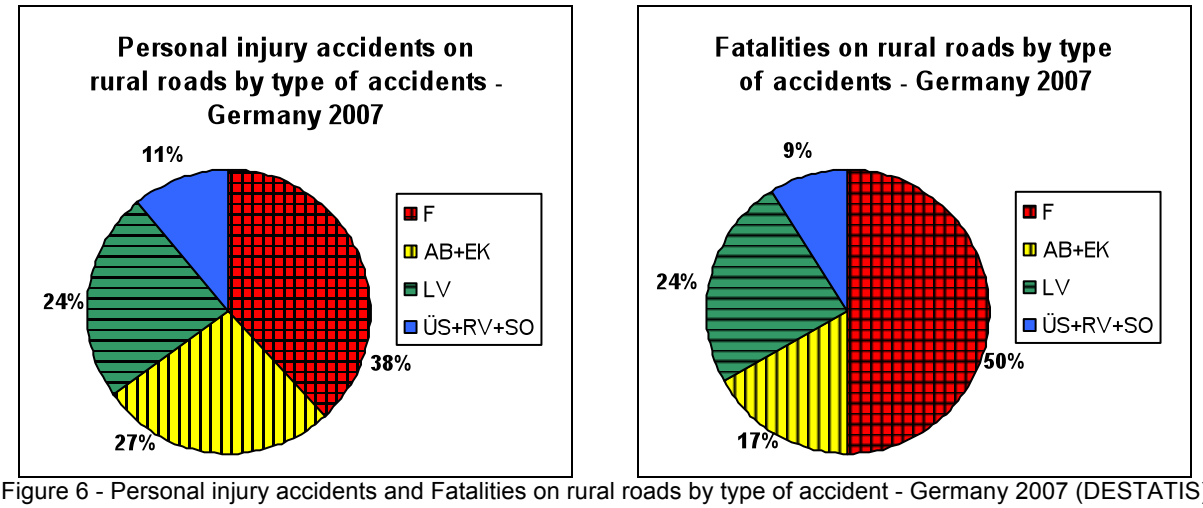

Figure 6 - Personal injury accidents and Fatalities on rural roads by type of accident - Germany 2007 (DESTATIS)

The other problem complexes are accidents at intersections (type AB an EK) and accidents between vehicles moving along the carriageway (type LV). About 25% of the personal injury accidents are attached to each of these types, and 20% of the fatalities. A considerable number of the LV-accidents occur in the situation of overtaking.

2.2.2 Kind of accidents on rural roads

The kind of accidents describes of the entire course of events in an accident, the direction into which the vehicles involved were heading when they first collided on the carriageway or, if there was no collision, the first mechanical impact on a vehicle. 10 kinds of accidents are distinguished. On rural roads only five of them are interesting:

kind 2: Collision with another vehicle moving ahead or waiting

kind 4: Collision with another oncoming vehicle

kind 5: Collision with another vehicle, which turns into or crosses a road

kind 8: Leaving the carriageway to the right

kind 9: Leaving the carriageway to the left.

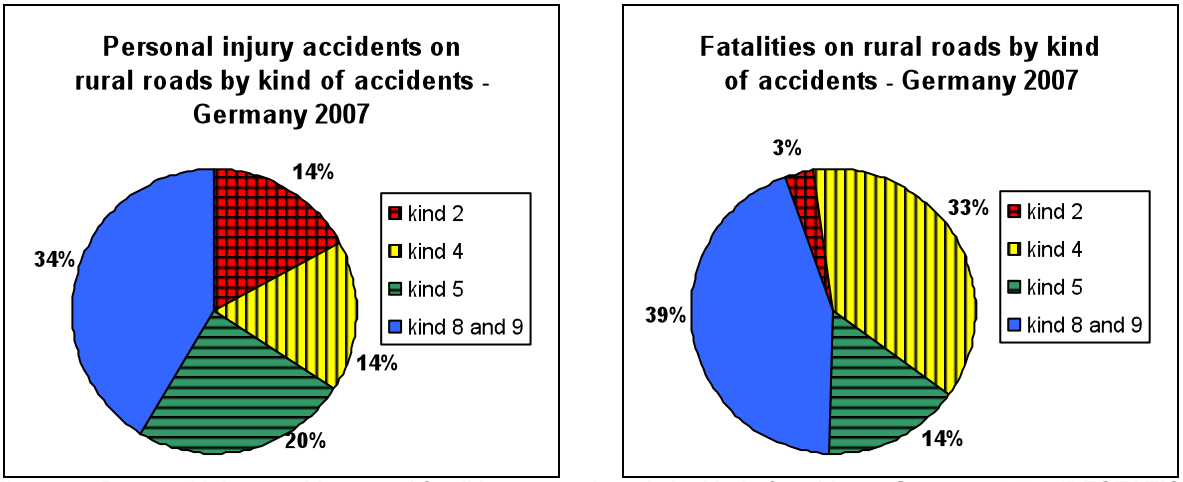

Figure 7 - Personal injury accidents and fatalities on rural roads by kind of accident - Germany 2007 (DESTATIS)

Figure 7 shows that one-third of the personal injury accidents and 39% of the fatalities are attached to kind 8 and 9 (leaving the carriageway). That underlines the need for paying special attention to the alignment and design of roadsides.

There is also a great proportion of collisions with another oncoming vehicle (kind 4). These are accidents with oncoming traffic but none of the colliding partners having had the intention to turn or to cross over the opposite lane. These accidents cause one-third of the fatalities on rural roads. The severity of collisions with oncoming traffic exceeds the average.

2.2.3 Accidents and obstacles on roadsides

About 40% of the fatalities on rural roads are to complain in run-off-the-road accidents. Since 1995 German statistics contain information about accidents with impact on obstacles on roadsides. Five types of obstacles are distinguished: tree, mast, abutment, crash barrier and “other” obstacle.

In 2007 about 87,000 personal injury accidents occurred on rural roads. 30% of these accidents were accidents with an impact on an obstacle, but 46% of the fatalities are to complain in these accidents.

A closer look at the fatalities in accidents with impact an obstacle reveals the main problem. About 65% of these fatalities are caused by collisions with trees.

So we have to realise that 896 persons died in 2007 on German rural roads in a collision with a tree. That means 30% of all fatalities on rural roads.

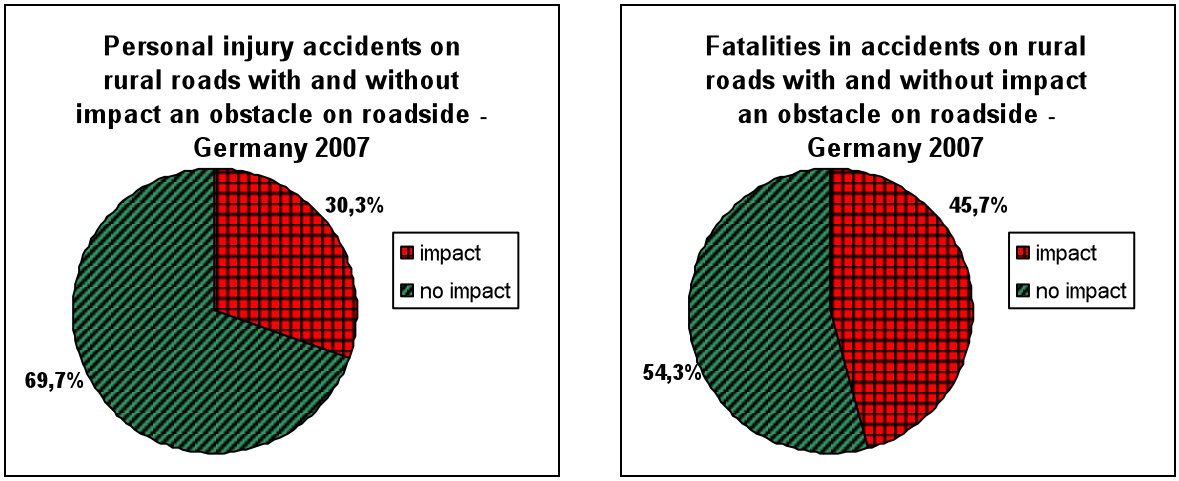

Figure 8 - Personal injury accidents and fatalities in accidents on rural roads with and without impact on obstacle on roadside - Germany 2007 (DESTATIS)

2.2.4 Accidents on rural roads by road users

The previous chapters considered the main characteristics of rural road accidents like the location, the type and the kind of accident. Now we will have a closer look at the road users involved in accidents. First we will analyse the fatalities by age group and location. Figure 9 shows the fatality rates for different age groups and different accident locations. The fatality rate here is defined as the number of fatalities in an age group per million population in this age group.

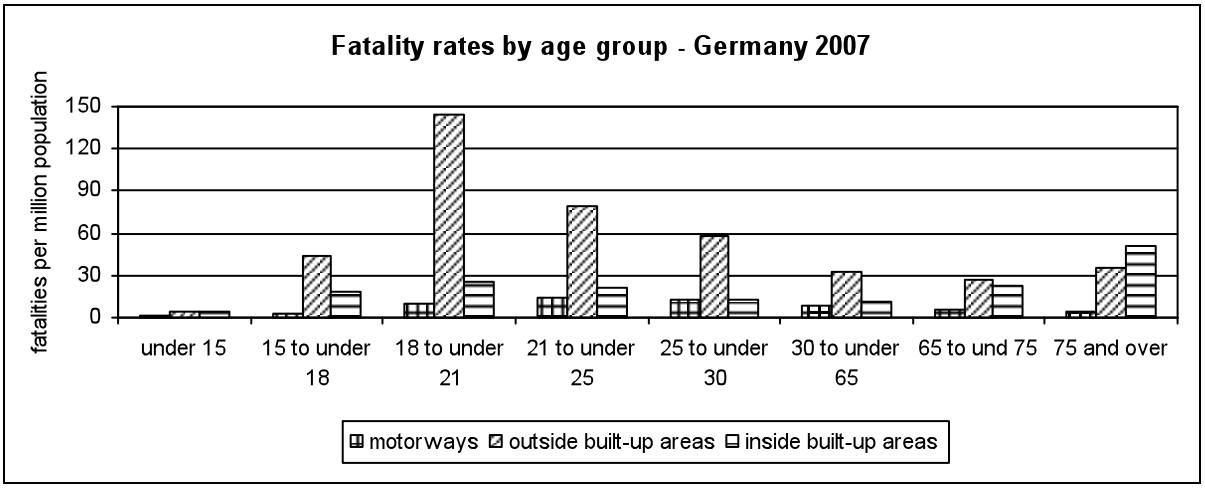

Figure 9 - Fatality rates by age group - Germany 2007 (DESTATIS)

In nearly all age groups we find higher fatality rates on rural roads than inside built-up areas or on motorways. But there is one age group with an extraordinary high fatality rate: novice drivers from 18 to 20 years. This fatality rate is four times higher than the average. Young drivers from 21 to 24 years also have a high accident rate. So we can state a very high risk for young drivers on rural roads.

Secondly, we analysed the fatalities on rural roads by gender. Fatality rates for male road users are consistently much higher than those of the female road users. We can find factors

of three or more comparing men with women. 56 male road users are killed per million male population, but 18 females per million female population.

The typical road user, killed in an accident on rural roads, is male and between 18 and 24 years old. This road user group has a proportion of nearly 20% of all fatalities on rural roads.

3 ROAD SAFETY MANAGEMENT IN GERMANY

A wide range of measures will be necessary to improve road safety on rural roads in a significant way. The main duties from our point of view are:

- Detection and elimination of Black Spots
- Safety analyses of road networks
- Safety inspections of existing roads
- Assessment of safety effects of planned new roads
- Control of planning and design of new roads by safety audits.

In the following will be described the situation in Germany on the way performing this tasks.

3.1 Black Spot and Network Safety Management

Police and road authorities accomplish local analyses of road accidents for various decades in Germany. Black-spot management is an integral part of local accident investigation. In the 1990s studies showed that the systematic of accidents with serious consequences is different from accidents with slight consequences. Since it is not possible to identify the principles involved in severe accidents by using one-year accident-type maps, three-year maps showing accidents with severe consequences are also necessary. Therefore in 2003 a new code of practice for the evaluation of road traffic accidents was issued (FGSV, 2003a), replacing the version from 1974. The second part of these guidelines provides information on selecting, financing and implementing schemes to counter black spots (FGSV, 2001).

The guidelines contain a new methodology of accident data evaluation. Besides the detection of local accident spots, now accident analyses are also looking for “accident lines” and “accident areas”. Accident lines are a typical problem of rural roads, accident areas are only relevant in the network of local roads inside built-up areas.

The definition of a local accident spot is the following:

- at least 5 accidents with comparable nature (e.g. identical accident type) during 12 months or

- at least 5 personal injury accidents during 36 months or
- at least 3 serious personal injury accidents during 36 months.

The limit values should not be increased (any longer) for high traffic volumes. Typical black spots, where deficiencies in the traffic and/or road engineering are contributing factors, often happen irrespective of the traffic load.

Accident lines are identified on the basis of a "visible accident density" using the accident map that shows the accidents with serious injuries during 3 years. Sections with a concentration of serious injury accidents of at least one accident per kilometre are considered as an accident line.

Detailed investigations are intended to ascertain why accidents occur at or in precisely the point or area of the road network that they do. Suitable improvement schemes can then be implemented on the basis of the investigation's findings.

The philosophy of black spot management is to identify locations with local risk factors that are related with the local detailed road layout. Besides these local analyses accident evaluation of whole networks are practiced in Germany since 2003. The methodology is described in the German Guidelines for Safety Analysis of Road Networks - ESN (FGSV, 2003b). The ESN enables road administrations to detect sections within the road network with higher accident level. In these sections deficits in road infrastructure have to be expected. The sections are evaluated by accident cost-rates. Comparing the accident cost-densities in reality with the theoretical costs, if the road section would have a best practice design, it is possible to calculate the so-called "safety potential". The calculated safety potentials can be mapped to give an overview of the road network.

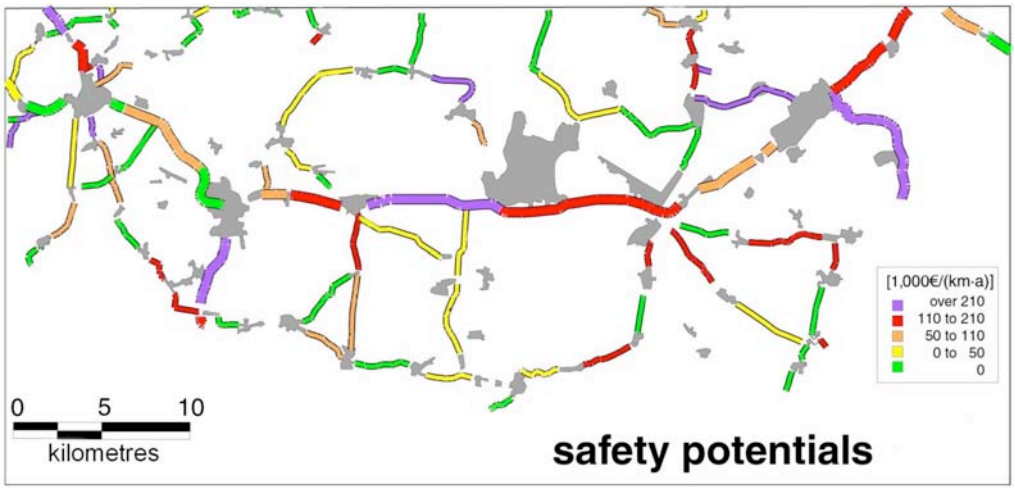

Figure 10 - Example of a distribution of safety potentials in a road network (FGSV 2003b)

As the safety potential is given in accident costs, it can be related to the later costs of possible improvement measures. So the road administration is able to identify the road sections where safety improvement measures are expected to have the best efficiency. Priority lists can be compiled concerning the limited resources for improvement measures.

There are first experiences applying the methodology of ESN for greater networks. The German Federal Highway Research Institute has already successfully applied the ESN to the motorway network. Experiences gathered in the development and use of ESN have been exchanged in a cooperation with the French "Service d'Études techniques des routes et autoroutes" (BASt and Sétra, 2005). A pilot application has been executed with the road network of Rhineland-Palatinate (Weinert and Vengels, 2008). A major result of this study from the point of methodology was that a longer investigation period of 6 years accident data turns the results more stable. Therefore an extension of the evaluation period proposed by ESN was recommended.

Actually in preparation is a Road Safety Manual. This manual will integrate the black spot and network analyses. Additionally it will offer a methodology to assess the impact of plans for new roads and reconstructions under the perspective of road safety. The target is to calculate extra accident costs for all deviations from a best practice design. So it will be possible to estimate the probably accident cost-rate of different alternative solutions for planned roads or reconstruction design. The calculated cost-rates will be related to six levels of safety from A to F. This is a similar methodology like the level of service. The discussion is still in process.

3.2 Road Safety Inspections

To check the existing road network for deficiencies in periodic time intervals, in 2007 Road Safety Inspection Guidelines (FGSV, 2007) were issued in Germany. These guidelines distinguish between regular and specific inspections. The regular inspection is to be done periodically in a cycle of 2 years for major roads and in a cycle of 4 years for local roads. Main subjects are safety-related road signs, markings and hazards at the edge of the carriageway and in the roadside environment. Specific inspections are those at nighttime to control road markings and traffic signs as well as street lighting especially at pedestrian crossings and refuges; inspections of level crossings; inspections of tunnels; inspections of destination signs. All these specific inspections are recommended to be achieved in a cycle of 4 years.

Looking at quality management of this road safety instrument in practice two points are important for efficient road safety inspections: human and financial resources in the road authorities and the qualification of the "inspectors". The first aspect is to be seen quite critical. A lot of local road administrations and police authorities are not able to provide the required staff for efficient road inspections. Hence, periods often are not complied or it is not possible to inspect the whole network. Secondly, road safety inspections have to be carried out by trained safety expert teams. Recently in Germany instruction and training programs started to improve the qualification and experience of the involved experts of road administrations and police authorities.

3.3 Road Safety Audits

A safety audit involves a systematic and independent investigation of the safety deficits for construction projects. The objective of the safety audit is to design roads for new construction, redevelopment, and expansion work as safely as possible and to minimise the risk of accidents as much as possible. The safety audit places particular emphasis on the issue of road safety in the entire planning, design, and construction process - it is an important part of a comprehensive quality management system.

Typical safety deficits affecting the design of rural roads are:

- inconsistent radii sequences
- no correlation of alignment and junction type
- lack of protection for left-turning movements
- insufficient cross fall in curves
- lack of strong and stable verges
- missing, insufficient or incorrect passive safety installations.

Various European countries introduced safety audits. In Germany the Guidelines for Road Safety Audits - ESAS were issued in 2002 (FGSV, 2002) and are now applied in practice.

The safety audit should be integrated in the whole planning and design procedure of a road project: during the preliminary planning stage, the preliminary design stage, the detailed design stage and shortly before, respectively after the opening to traffic.

Main actors are the client (i.e. road authority), who initiates the audit and decides on the follow-ups, and the auditors, who can be external experts but also members of the road authority. In any case it has to be ensured that the auditors are unbiased and not involved in the project. With regard to their qualifications, auditors must have extensive knowledge and experience both in design and evaluation of the safety of road traffic facilities. As a basic qualification, auditors should have completed a relevant university education or comparable training. Several years experience in the field of road design or in the area of road-related safety examinations are required. Apart from these basic requirements, additional qualifications should be gained by further training.

Curricular concepts for training of auditors were developed in the last years. In 2009 the FGSV issued Guidelines for Training and Certification of Auditors - MAZS (FGSV, 2009). The guidelines contain the qualification requirements of auditors, the training programs, examination subjects and regulations of certification and re-certification.

Universities, private companies and road authorities offer trainings. A list of corresponding institutions is published on the website of the German Federal Highway Research Institute (www.bast.de). There you can find also a list of accredited auditors.

In an appendix the ESAS contains checklists for audits in the different stages of planning, separated by motorways, rural roads, major urban roads and residential roads. As a helping tool you also find three exemplary audit reports.

4 SPECIFIC MEASURES IMPROVING ROAD SAFETY ON RURAL ROADS

The analyses of accident data in chapter 2 showed specific problems on rural roads. After having presented the general system of German road safety management, in the following we will report specific measures to improve road safety on rural roads.

4.1 Large-scale test with before/after-comparison

Available financial resources are not sufficient to adapt the entire network's safety to currently applicable bodies of rules. Consequently, a large-scale test is being conducted to ascertain whether simple and cost-effective measures can be used to increase the safety even of roads on which serious accidents occur repeatedly and which cannot be structurally extended in the foreseeable future. Accidents here are usually attributable to speeding and incorrect judgements of the distance or speed of oncoming vehicles. Accordingly, measures to counteract speeding and overtaking accidents have top priority.

The “AOSI project group”, comprising traffic safety experts from the German Federal Highway Research Institute, German Insurance Association and Technical University of Dresden has developed measures to improve traffic safety on two-lane rural roads. The practicability of these measures is now being examined in a large-scale test involving eleven selected routes. The selected routes have a total length of about 150 kilometres located in the states of Brandenburg, Saxony and Thuringia. The costs of the test are about 25 million Euros.

Concerning overtaking the following measures are to be tested: controlled and safe overtaking through construction of an additional overtaking lane; installation of overtaking prohibitions and related modifications of dual partitioning lines. This project is still in progress.

Concerning speed monitoring the compliance with appropriate speed limits through installation of stationary units (speed cameras), installed in succession on routes about 10 kilometres long, is tested. In March 2009 the results of the before/after-comparison were presented (Lippold, Weise and Jährig, 2009).

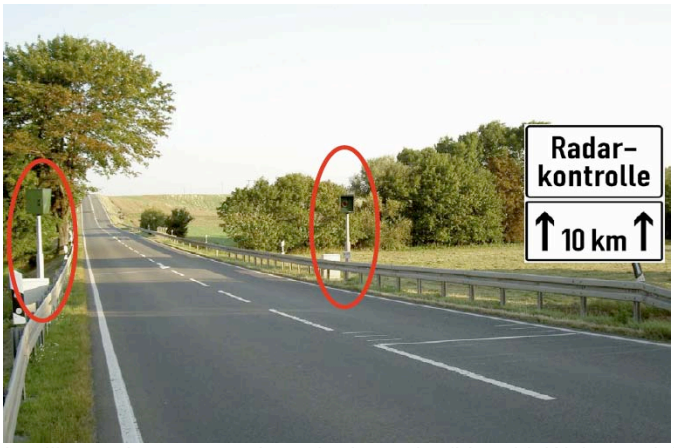

Figure 11 - Line-like stationary speed monitoring units (Lippold, Weise and Jährig, 2009)

Five sections with a length of about 75 kilometres and 40 speed cameras were tested. The methodology comprises local speed measurements before and after, recording of speed profiles, inquiries of road users and accident data analyses (3 years before and after).

On all routes with large excesses of speed limits before, speed levels were significantly reduced. The speed levels are now much more closer to the speed limit in force. The effect occured not only close to the speed cameras, but also in the sections between. The evaluation of the speed profiles approved these results and showed more homogeneous speed gradients.

The number of serious injury accidents declined clearly. After the installation of the line-like speed monitoring units fatalities were reduced about 59%. The number of serious casualties decreased about 34%.

There is a wide acceptance by road users, at least after a certain acclimation period. The acceptance differs clearly from the objections raised by the local press in the phase before the installation. Drivers that participated in the survey didn't feel a significant reduction of driving time, they stated a more relaxed driving.

4.2 Collisions with trees

The accident data analyses showed that 30% of all fatalities on rural roads occur as a collision with trees. In regions with the typical "avenues" like Brandenburg more than 60% of the fatalities on rural roads occur as a collision with trees.

Road users are not informed about these risks. In a representative survey, more than 50% of the respondents said that tight curves are very dangerous, but only 13% considered trees standing near at the roadside as a danger. About 80% of the motorists feel save driving in an "avenue", only 4% consider this as dangerous (Ellinghaus and Steinbrecher, 2003). These results show that information and education of road users are necessary.

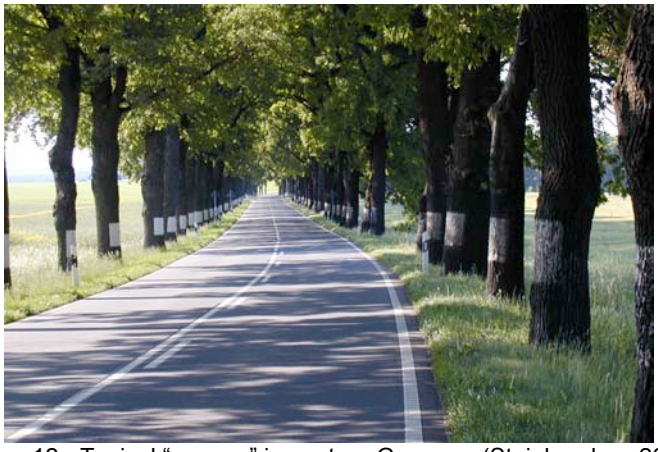

Figure 12 - Typical “avenue” in eastern Germany (Steinbrecher, 2003)

Furthermore measures are required to avoid run-off-the-road accidents and to mitigate consequences in the case of an accident on a road with trees at the roadside. Analyses of accidents showed that on rural roads the risk to die in a collision with a tree is more than five times higher compared with a run-off-the-road accident in the situation of an obstacle free roadside. In this context, the German Road and Transportation Association issued a guideline (ESAB) in 2006, which yields a methodology to identify sections with a distinctive high frequency of tree collisions and recommends countermeasures (FGSV, 2006).

The catalogue of countermeasures can be structured in:

- design measures like adaption of curve radii, increase of cross fall or improvement of road surface condition,
- guardrail,
- speed limits and monitoring.

A combination of different measures can make sense. Only in case that none of these measures at all are appropriate to improve road safety, trees have to be removed.

4.3 Young drivers

The accident risk of young drivers is above average. Road accidents are the number one cause of death among teenagers. This is a worldwide problem, in the OECD countries young drivers only are 10% of the population, but 27% of all driver fatalities occur in this age group (OECD, 2006). Besides we have to consider that it is not only a problem of the young drivers themselves, for each killed young driver about 1.3 “others” die.

Even in countries with good general results in improving road safety the 18 to 24 year-old group has higher accident rates and their accidents have more serious consequences. Hence, the efficiency of infrastructure measures is limited to resolve the problem of young drivers. For better results it is necessary to look at the personal disposition of young drivers and the effects on driving behaviour. Some novice drivers are more willing to take risks and

need excitement, they want to explore their limits. Another important factor is the lack of driving experience that can lead to underestimation of danger and overestimation of the own skills.

Both factors, lack of experience and high-risk acceptance, play an important role for young drivers' behaviour on rural roads. Driving on rural roads is a difficult task that requires cognitive and anticipatory capacities. Because of the relatively high-speed level, decisions have to be taken quickly. Behaviour associated with a specific design or design elements has to be learned. In this aspect motorways are much more self-explaining than rural roads. Therefore, implementing self-explaining road design will improve the perceived characteristics of rural roads, especially for young drivers (RIPCORD-ISEREST, 2007).

On the other hand driving on rural roads has an emotional dimension. It is much more interesting to drive on rural roads than on motorways or in urban areas, especially looking at fun, sportive driving or speeding. Surveys show that the dimensions "fun and speed" on rural roads depend on the age of the driver: 33% of drivers under 21 years said that they have a lot of fun driving fast on narrow and winding rural roads, 26% don't have fun to do so. The proportions for drivers between 40 and 60 years are 22% and 45% (Ellinghaus and Steinbrecher, 2003).

A lot of studies in the past decades were carried out to investigate if the lack of experience or the high-risk acceptance is the key factor. In an early study, a group of younger and a group of older drivers were observed during a trip in a real traffic environment, following by a questioning session and a personality test (Schlag, Ellinghaus and Steinbrecher, 1986). Approximately 43% of the young drivers behaved in a rather risky manner during the trip, while 57% of this age group displayed a behaviour similar to that of the older drivers. Especially on the sections of rural roads some novice drivers showed the dangerous mixture of problems in the right interpretation of the following situation (i.e. curve) and greater degree of risk acceptance. The study showed that driving experience depends on the mileage done, but risk disposition on age.

An OECD-study (OECD, 2006) comes to the conclusion that the key factors behind the high levels of young driver risk are experience, age and gender. Inexperience has an enormous impact on risk, particularly in the few years immediately following licensing. At the same time, risk levels decrease as the age of initial solo driving increases, meaning that age itself is an important contributing factor.

Recommendations are to introduce accompanied driving as an instrument to boost experience and at the same time to introduce restrictive measures like zero alcohol in the first years of driving. In Germany both regulations are in force recently.

5 CONCLUSIONS

In recent years great advances have been achieved in road safety. In many European countries the number of personal injury accidents and the number of fatalities decreased significantly. But the analyses of accident data also show that there are still some major problems. Especially on rural roads the accident severity is very high. In Germany the risk of being involved in a fatal accident on rural roads is more than twice as high as inside built-up areas and more than four times higher than on motorways.

The detailed analyses of accidents on rural roads showed some key factors for road safety work in the future. The main problems on rural road accidents are caused by driver errors. 50% of the fatalities are caused by these accidents. Reasons for losing control of the vehicle are inadequate speed, misjudgement of the course or conditions of the road. 39% of the fatalities are attached to run-off-the-road accidents and 30% of the fatalities occur as a collision with a tree. We also have to focus on the road users involved in the accidents. Analyses show that the group of young drivers is a grave problem, particularly young male drivers. Nearly 20% of fatalities on rural roads are young man between 18 and 24 years.

There is an extensive range of measures responding to these problems and improving road safety on rural roads in Germany. The German road safety management system comprises black spot management, network safety management, road safety inspections and road safety audits. New guidelines make sure that in the black spot management, besides local accident spots “accident lines” are identified. “Accident lines” help to find problematic sections in the network of rural roads. In addition a methodology to analyse whole networks and to assess the “safety potential” was introduced. This enables road authorities to identify road sections where safety improvement measures are expected to have the best efficiency.

Three years ago guidelines for frequent road inspections were issued and in 2002 the German Transport Ministry introduced guidelines for safety audits in all stages of planning and design. There are training programs for auditors. The list of certified auditors comprises more than 150 engineers.

Furthermore there are specific measures to improve safety on rural roads. A large-scale test investigates the effects of overtaking lanes and speed surveillance over long distance. First results show that speed monitoring measures are able to improve road safety, the speed levels on the tested routes decreased, even in the sections between the camera locations, the acceptance by road users was quiet good.

A new guideline yields a methodology to identify sections with a distinctive high frequency of tree collisions and recommends countermeasures. Only in case that none of the measures at all is appropriate to improve road safety, trees have to be removed.

To reduce high risk of young drivers, that is particularly problematic on rural roads, the German government introduced accompanied driving. At the same time there are restrictive measures for young drivers like zero alcohol.

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