TRACE Project. Deliverable 3.3. Trip related factors

S. Schick, A. Eggers, C. Pastor, P. van Elslande, K. Fouquet, Arnaud Banos, J. Plaza, C. Naing, E. Tomasch, W. Hell

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Trip Related Factors

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Author(s): Schick S. (LMU), Eggers A. (BASt), Pastor C. (BASt), van Elslande P. (INRETS), Fouquet K. (INRETS), Baños A. (CIDAUT), Plaza J. (CIDAUT), Naing C. (VSRC), Tomasch E. (TUG), Hell W. (LMU)

Participant(s): LMU, BASt, CIDAUT, INRETS, VSRC, TUG

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Validated by WP3 Leader: Sylvia Schick (LMU)

Sub-Reports Reviewed by external reviewers: Céline Lemercier (University of Toulouse, F) Thierry Serre (INRETS LBA), Nicolas Clabaux (INRETS), Blandine Gadegbeku (INRETS – UMRESTTE), Viola Cavallo (INRETS-Driving Psychology Labaratory)

Reviewed by external reviewer: Kristin Thorsteinsdottir (LMU)

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Abstract:

WP3 of the European Project TRACE is concerned with Types of Factors to analyse the causation of road traffic accidents from a factors' point of view. In task 3.3 'Trip-related Factors' it was tried to characterise accidents that are caused by certain contributing factors found on a trip level.
This was done by applying one statistical method to existing databases of the WP3 Partners on the one hand and on the other hand by performing an in-depth case analysis using the WP5 method.
The analysed factors stem from the Human Component of the accident causation classification, namely "alcohol", "vigilance", and "experience", from the Vehicle Component, namely "vehicle condition/maintenance", and from the Environment component, namely "road layout" and "road condition". This selection resulted from the task 3.1 conclusions and feasibility reasons.
Due to inhomogeneous results for the databases from Austria, France, Germany, Great Britain, and Spain the detailed results will be pictured in an Internal TRACE Report by Sub-reports of the WP3 Partners, in this task report the main results are discussed with respect to findings and data in other databases available to the TRACE partners as requested from WP8.
Both methods applied show that trip-related factors are possible to prevent not on a trip level only, but also from a background level and as well on a level closer to the accident (driving task level). However, only some suggestions are possible to give by these results. A more detailed view for preventing the different accidents that result from trip-related factors is necessary, as shown by the results of BASt with the statistic method, as well as by INRETS with the ultra in-depth WP5 method.

Keyword list: trip level, accident causation, contributing factors, alcohol, vigilance, experience, vehicle condition, road condition and layout

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1 Executive Summary

Within Workpackage 3 of the TRACE Project the first task 3.1 (see also D3.1, Schick S., 2007) was concerned with accident related factors. This Deliverable 3.3 demonstrates the work performed for task 3.3 "trip-related factors". The factors analysed for this task had been chosen according to the results of task 3.1.

Trip-related factors are defined by an intermediate level in the causal chain of an accident. The accident causation model based on factors as provided by task 3.1 implies the idea that certain background factors have influences on factors that are acting on the following levels of the trip and further on the driving task. Trip related factors themselves can influence the driving task associated factors. The levels picture the time between the occurrence of the factors and the accident. Factors from all levels might act independently or depend on each other (either by being caused by a preceding factor or by interacting with each other) both as accident related factors contributing to the accidents' occurrence.

In task 3.3 some trip-related factors from all three components (HUMAN, VEHICLE, and ENVIRONMENT) were chosen to analyse accidents where those factors contributed more deeply. The analysis gives answers to the question if accidents where a specific factor was contributing differ from other accidents.

The selected factors from the HUMAN component are "Alcohol", "Vigilance", and "experience".

Alcohol refers to all information available indicating that influence of alcohol was present during the trip.

Vigilance refers to all states (not actual and dynamic conditions) concerning the human state of being awake on a normal level (the extremes referring to vigilance would be deep sleep/coma and on the other extreme hyperexcitation) that contributed to an accident occurrence, e.g.: fatigue, under influence of alcohol or narcotics or other drugs and medications, exhaustion and physical fatigue, chronic diseases with restrictions in vigilance, (not to be mixed up with distraction and attention deficits that are possible while being wide awake).

Experience refers to all states concerning the humans low experience in driving a vehicle that contributed to an accident occurrence, e.g.: novice driver, foreign driver, driving seldom, driving in traffic someone is not used to (city traffic while used to rural sites), not enough knowledge of the traffic rules and informal laws, or, the driver indicates that he/she "does not have enough experience"

For the VEHICLE component the attempt of analysing "vehicle condition/maintenance" was undertaken.

Vehicle condition /maintenance refers to all states (not actual and dynamic conditions) concerning the vehicle that contributed to an accident occurrence, e.g.: low tyre pressure or profile, any existing defects of brakes, steering, suspension, cracks in windscreen, no wiping water, etc., that are not suddenly occurring (like an acute tyre blow-out) but are known when starting the trip.

Factors from the ENVIRONMENT component with need for in-depth analysis are "road geometry and layout" and "road condition".

Road layout refers to all states (not actual and dynamic conditions) concerning the road that contributed to an accident occurrence, e.g.: narrow road, state of surface (potholes), bend, state or absence of signs or signals, defect/dim lighting, grooves in connection with rain, irregular condition of traffic signs, insufficient lighting, insufficiently secured railway crossings or other constant road conditions.

These definitions could be adapted by the partners according to their database structure; this will be indicated in the sub-reports if applicable.

Two different methods were used for the analysis in task 3.3.

Four Partners of WP3 (BASt, CIDAUT, TUG (Subcontractor for LMU), VSRC) used their existing database and prepared it for a statistical method to compare accidents in which certain factors contributed to their occurrence with accidents where this factor didn't contribute. The results to be obtained by this are patterns of accident characteristics in terms of objective explanatory variables that are able to distinguish and therefore define types of accidents.

Two Partners of WP3 (INRETS, VSRC) used their in-house accident cases and applied the method presented by Workpackage 5 in the TRACE-Project, to analyse accidents with a certain trip-related factor with the human functional failure analysis leading to prototypical scenarios.

In addition a data request to WP8 of the TRACE project was used to calculate bivariate associations between requested explanatory variables and the mentioned contributing factors. These were used to compare the results found by the WP3 Partners with other countries and see, if certain patterns hold to be unique or have to be regarded as specialties.

The factor alcohol was analysed by BASt and TUG using the statistical method and by the VSRC by applying a more general statistical method and by applying the WP5 method.

The analysis of the factor alcohol by BASt (GIDAS database, Germany) showed that typical accident circumstances and person characteristics were overrepresented in alcohol related accidents involving passenger cars compared to the accidents where alcohol was not involved. The typical alcohol related accidents seem to occur on weekends at night hours. The driver is typically male and the purpose of the trip is “leisure”. These include the stereotypical alcohol related accidents which occur when young people during the weekend drive home after alcohol consumption at a discotheque or party. A possible counter measure to reduce the occurrence of these accidents would be to increase alcohol controls for this special type of road users and trip circumstances. Comparison of this result might be possible to the Czech Republic, France, Italy, and the UK.

The analysis of the factor alcohol by TUG (ZEDATU database, Austria) showed the following: Out of the selection of analysed explanatory variables six variables are connected to the contributing factor “alcohol” forming a pattern to distinguish these accidents from those where alcohol didn't contribute. These are identified as vehicle group (vehicles/vans), engine power (higher motorization), time of week (weekend), road type (other road), time of day (16 to 23:59), and lighting condition (daylight). “Lighting conditions” can be seen as the most significant factor. Basically alcohol-related accidents occur on weekends. Increasing the monitoring activities by the police with regard to drunken drivers would have the highest impact on urban areas between 16:00 and 23:59. Countermeasures such as monitoring by the police or alcolock keys could help to reduce fatal accidents. The Czech Republic and Italy are potentially comparable to these findings.

The analysis of the OTS database by VSRC (UK) showed that alcohol related accidents happen to occur more often on minor, urban, single carriageway roads with low speed limits (30mph/48kph) especially in bends, leading to single car collisions or car vs. pedestrian collisions with frontal impacts where no manoeuvre was undertaken; with the traffic participants being involved being more often car drivers or pedestrians; male drivers at night during light density traffic conditions, when compared to other accidents.

The in-depth results revealed that there was not one typical failure generating scenario for the road users who were alcohol impaired in the accidents. However, from the accidents analysed, it was found that alcohol impairment can affect a driver’s or pedestrian’s ability to correctly judge the road ahead and also make the correct decisions while driving/attempting to cross the road. Alcohol impairment was also found on occasions to be the overriding factor in the accident (i.e. if the road user was not impaired by alcohol, there would have been no functional failure and the accident would not have occurred). Typical failure generating scenarios were also identified for many of the non primary active road users in the accidents, who are the road users who did not cause the initial ‘disturbance’, but for some reason did not or were unable to avoid to resulting impact. For the non primary active road users the scenarios mainly related to a failure to detect the primary active road user, who was either in plain view or out of view. Comparable results might be obtained from Germany, France, the Czech Republic, and Italy as shown by the bivariate consensuses.

The factor "vigilance" was analysed by CIDAUT with the "statistical method" and by INRETS with the "WP5 method".

Regarding cross tabulation results from the analysis performed by CIDAUT (DIANA database, Spain), vigilance as a contributing factor is associated with intersection, active safety system, time of accident, road type, luminosity and speed limit. As it will be dealt with in the discussion chapter in the CIDAUT sub-report (4.5), the results are in accordance with the conclusions found in literature review for accidents where vigilance is contributory. The measures that will be proposed considering the results in accident level refer to luminosity, specially in highways; research and implementation of in-vehicle systems to support drivers performance, such as Drowsy Driver Detection System or Lane Keeping Assistant; and finally, educational campaigns to promote safety habits related to trips, such as the time for travelling, the necessary rests, an adequate judgement of their own state considering drowsiness and the subsequent decisions. Best transfer of these results is possibly applying to the UK.

The "WP5-method" as applied by INRETS (EDA database, France) reveals that for vigilance related accidents some typical scenarios can be established. Vigilance related accidents are occurring due to drowsiness, faintness, states of reduced vigilance and alcohol intake, psychotropic drugs and narcotics. Usually these accidents occur because of the human functional failure encountered is classified as an "overall failure". For this failure twelve prototypical scenarios could be elaborated of which 5 relate to the alteration in abilities (29.2%), 6 scenarios that relate to the loss of psycho-physiological abilities (28.5%), and one scenario related to the failure of overwhelmed processing abilities (5.3%). In addition some vigilance related accidents occur due to failures in diagnosis (underestimating a passing road difficulty with 5.5%), decision (deliberately disobeying a safety rule with 7.6%) or execution of a task (poor control of an external disturbance with 4.7%) that are represented in another 4 prototypical scenarios. For these scenarios different prevention measures might apply. Only the statistic data from Italy give an indication for possible transfer of these findings to other countries.

This factor "experience" was analysed by CIDAUT with the "statistical method".

As cross tabulation results show no association between Experience and any environmental characteristic, no conclusion about this factor in accident level can be drawn. The explanatory variables in the DIANA database more associated to experience related accidents are the variable age group (18 to 25 year olds), driver type (private driver) and employment (student driver). Furthermore, experience related accidents don't show up primarily in certain traffic situations, on specific types of roads, in certain vehicles or all other explanatory variables. In addition experience related accidents are not typical for one gender only.

The factor "vehicle condition/maintenance" was analysed by CIDAUT and by BASt using the statistical method.

The cross tabulation results calculated by CIDAUT show an association between vehicle condition and vehicle power on one hand, and on the other hand between vehicle condition and day of week. In accident level, the presence of “day of week” variable suggests the necessity of a periodical schedule for reviews (related to periodical trips), whose frequency could be made more precise using in-depth analyses of vehicle condition factor. Nevertheless, more investigation in this way is required.

The analysis by BASt showed that the street type “motorways” was significantly overrepresented in accidents related to vehicle condition. The reason could be that only at high velocities a vehicle defect resulting from maintenance problems leads to a severe accident. At low velocities the driver can keep control of his vehicle. This is confirmed by the finding that urban roads are significantly underrepresented in the group of vehicle condition related accidents. A possible solution to reduce the number of accidents related to vehicle condition would be a frequent check of the vehicle condition of vehicles which are operated on a regular basis at high velocities.

A transfer to the other countries as represented by the WP8 request is not possible.

The factor "road condition" was analysed by BASt using the statistical method.

The investigation of the trip related factor of the environment component “road condition” showed that urban locations are highly underrepresented in the group of accidents related to road condition. Thus improvement of road condition should be focused on rural areas. Furthermore, the type of accident “driving accident” was overrepresented in the group of accidents where road condition was contributing. Driving accidents are normally single vehicle accidents, which result from unadapted behaviour of the driver with regard to the circumstances of the accident scene. In the case of road layout related accidents this means that the driver failed to adapt the speed to the bad road condition. A possible solution to improve this situation and reduce the number of accidents related to road condition could be driver education or more warning signs, if appropriate, advising the driver of upcoming bad road conditions. Also driver assistance systems to warn the driver of bad road conditions could be beneficial for this type of accidents. Partly the pattern might be possible to transfer to Czech Republic, Italy and the UK.

The factor "Road layout" was analysed by the VSRC by applying a more general statistical method and by applying the WP5 method.

For cases where road layout was a contributory factor, the statistical overview revealed that road layout was more likely to be causative on quiet, high-speed, minor, rural, single carriageway roads with low density traffic at night, not at an intersection, involving a single car with a young driver who was not undertaking a manoeuvre, but going ahead on a bend with a degraded road surface (defects or contaminants).

The in-depth results revealed that the most frequent typical failure generating scenarios for the primary road user involved either taking an intentional risk (failure in decision making) when negotiating a bend or not correctly evaluating a bend (failure in diagnosing situation). For the non primary active road user the scenarios were mainly related to their pre-defined expectations of the primary active road user’s manoeuvres (or lack of) who was in plain view. The findings of the in-depth VSRC analysis might only be partly possible to transfer to the Czech Republic and Italy

The discussion of the results uses the suggested active safety measures as presented by the EU-Project TRACE Deliverables D6.1 (Barrios et al., 2007) and D4.1.5 (Van Elslande et al., 2008) and other prevention measures to give suggestions towards the prevention of accidents where the analysed factors contributed to.

In general some conclusions towards prevention suggestions can be given.

Alcohol related accidents can be prevented by law enforcement (more controls, target group males, target time: from 4 pm to 8 am, target sites: urban), by education (target group males, unemployed), and by Active Safety Devices in Vehicles like Alcolock Key, but also Intelligent Speed Adaption (ISA) on a mandatory level, Lane Keeping Assistance, Electronic Stability Program (ESP), Brake Assist, Active Cruise Control (ACC), Collision Avoidance, Vulnerable Road Users Protection) and even also Night Vision can be suggested to prevent alcohol-related accidents .

Vigilance related accidents might be prevented by educational campaigns (target groups: younger drivers with alcohol involvement in a festive context, a second group of around 40 year olds with chronic alcohol consumption problems, and elderly people with cognitive slowdown and fatigue, target sites: highways), by Active Safety Devices in Vehicles like Driver Drowsiness Detection, Alcolock Key, ISA, ESP, Lane Changing Assistance, Night Vision, and Advanced Adaptive Front Light System, and by infrastructural measures for reducing highway monotony and improving lighting.

Experience related accidents might be prevented by Intensifying of driving licence driving lessons and some graduated driver licensing programs for novice drivers.

Vehicle condition related accidents can be prevented by more regular mandatory technical checks (target group: commercial trucks, especially tyre condition to be checked), by educational advertising (picture the dangers stemming from bad vehicle conditions and tyre conditions, respectively), by regular traffic checks focussing on technical vehicle condition (target site: before entering highways), and by Active Safety Devices in Vehicles like Tyre Pressure Monitoring and Warning systems.

Road condition related accidents can be prevented by improvement of road maintenance efforts (target site: rural, without traffic regulation), but no further recommendations can be derived.

Road layout related accidents can be prevented by educational and information campaigns on the danger of bends/steep hills and narrow roads (target groups: younger drivers), by infrastructural improvements like signs of warnings and speed limit reductions (target sites: in approaching of bends on minor, rural roads), and by Driver Assistance Systems in vehicles like Brake Assist, Collision avoidance, Collision Warning, ESP, and ISA, but also ACC, Night Vision, and Lane Keeping Assistance might be beneficial.

The advantage of the "statistical method" is that without exposure data typical patterns for certain contributing factors for traffic accidents can be derived. From the idea to compare different accidents, that are characterised by one contributing factors' presence or absence in these accidents, some general pattern can be found by the statistical method.

The "WP5 method" is of course able to split a trip-related factor to underlying factors and find typical scenarios for underlying factors all describing circumstances for one trip-related factor. This method has a completely different approach and can therefore give answers to more detailed questions, than just the comparison of accidents with or without a certain trip-related factor.

From the BASt analysis one further conclusion can be drawn: One condition which was significantly overrepresented in all investigated trip related accidents was that trip related accidents had more than one accident causally contributing factor. The reason could be that trip related risk factors always need at least one additional triggering factor to generate an accident.

For future analyses of this kind it would be therefore very advisable to take multiple trip-related factors into account simultaneously instead of focusing on one contributing factor. Especially databases with coding and classification structures that on the one hand allow to code multiple contributing factors and are predominantly collecting factors on a trip level have to take these considerations into account.

A complete overview of the WP3 work and its impact on the prevention of traffic accidents in Europe by analysing accident causation from a factors point of view can only be given by taking into account the results of all tasks in WP3 and will be presented in D3.5 as a final conclusion.

2 Introduction

TRACE tries to view accident causation from three different points of view. In WP3 "Types of Factors" the view from the factors and risk factors, respectively is taken. WP1 focuses on different road users, WP2 on different situations, each analysing the accidents from these viewpoints, trying to gain knowledge on typical accidents or pattern of factors contributing to these typical accidents. In WP3 different factors are used to analyse if they are associated to typical accidents.

Within Workpackage 3 of the TRACE Project the first task 3.1 was concerned with all accident related factors and their classification. This Deliverable 3.3 demonstrates the work performed for task 3.3 "trip-related factors". The factors analysed for this task had been chosen according to the results of task 3.1.

Trip-related factors are defined by an intermediate level in the causal chain of an accident. The Trip-related factors are defined by an intermediate level in the causal chain of an accident. The accident causation model based on factors as provided by task 3.1 implies the idea that certain background factors have influences on factors that are acting on the following levels of the trip and further on the driving task. Trip related factors themselves can influence the driving task associated factors. The levels picture the time between the occurrence of the factors and the accident. Factors from all levels might act independently or depend on each other (either by being caused by a preceding factor or by interacting with each other) both as accident related factors contributing to the accidents' occurrence.

Not only levels but also components classify all accident related factors, precisely the HUMAN, the ENVIRONMENT and the VEHICLE components.

On a background level societal and cultural factors (as analysed by task 3.2) and political, economical and geographic conditions can have an influence on the accident causation. On the trip level factors are found that are acting during the whole trip someone is undertaking. The factors refer to constant states and slowly changing conditions in terms of lasting at least hours or the time of the trip. Trip related factors themselves can have an influence on the driving task level, but independently factors from both levels can contribute to an accident's occurrence.

By literature review and database analysis the most relevant factors on a trip level were found to be alcohol and vigilance which relate to the human component.

In task 3.3 some trip-related factors from all components were chosen to analyse accidents where those factors contributed more deeply. The analysis gives answers to the question if accidents where a specific factor was contributing differ from other accidents.

Two different methods were used for the analysis in task 3.3.

Four Partners of WP3 used their existing database and prepared it for a statistical method to compare accidents in which certain factors contributed to their occurrence with accidents where this factor didn't contribute. The results to be gained by this are pattern of accident characteristics in terms of explanatory variables. Those should be able to distinguish and therefore define typical accidents related to the specific factors.

Two Partners of WP3 used their in-house accident cases and applied the method presented by Workpackage 5 in the TRACE-Project, to analyse accidents with a certain trip-related factor with the human functional failure analysis leading to prototypical scenarios.

In chapter 3 the results of the analyses of each factor will be presented for all partners in an overview by extracting the main results. These will then be compared with the data from other TRACE Partners as requested from WP8. In the discussion part it is tried to compare the different results for obtaining an overview if the findings are somewhat unique or can be transferred to other countries. In chapter 4 a translation of the results to possible conclusions also for prevention measures is performed.

In the sub-reports provided by each Partner their applied analysis method, their database and factors selected as well as their results according to the chosen method and the discussion and conclusions of their results are presented in detail. These are published as an internal TRACE Report – Collection of Sub-reports for task 3.3.

3 Material and Methods

The distribution of methods and factors to partners should provide comparable results on the one hand, but should also cover a variety of factors, and apply the best usable knowledge of data available, and use methods as suggested by other TRACE WPs (WP5 and WP7).

The expected outcomes are differing for the statistic database analysis as performed in-depth by the statistic modelling and for the case analysis as performed in-depth by the WP5 method.

The database analysis can only give answers to what characteristics are found typically with accidents that are caused by one contributing factor of interest in comparison to other accidents. The statistic method avoids regarding other factors to be able to find objective characteristics typical for one contributing factor and not for a combination of factors. Taking multiple factors into account simultaneously was not wanted, as the attempt of regarding accidents from a factors' point of view was to be tried. Anyhow, the necessary methods would have had to be performed by experts. See also WP7 reports of the TRACE Project.

The WP5 method can give answers what failures of the primary active and of the non primary active road users lead to the accidents occurrence that was assumed to be caused by one contributing factor of interest. In addition not only the failures but the circumstances in which these failures occurred and underlying factors for the contributing factors' contribution to the accident can be found.

The methods are described in detail in the following chapters and for each Partner in the INTERNAL TRACE Report – Collection of Sub-reports for task 3.3.

3.1 Selected trip-related factors

Based on the results from task 3.1 it was decided to focus on trip-related factors from all three components (Human, Vehicle, and Environment).

Factors with assumed impact on traffic accident causation and need for in-depth analysis from the HUMAN component are "Alcohol", "Vigilance", "experience", and "medical condition".

"Alcohol" is defined by either blood test or breathing test result or drivers own statement.

"Vigilance" refers to all states (not actual and dynamic conditions) concerning the human state of being awake on a normal level (the extremes referring to vigilance would be deep sleep/coma and on the other extreme hyperexcitation) that contributed to an accident occurrence, e.g.: fatigue, because of the influence of alcohol or narcotics or other drugs and medications, exhaustion and physical fatigue, chronic diseases with restrictions in vigilance, etc. It is not to be mixed up with distraction and attention deficits that are possible while being wide awake.

"Experience" refers to all states concerning the humans' low experience in driving a vehicle that contributed to an accident occurrence, e.g.: novice driver, foreign driver, driving seldom, driving in traffic someone is not used to (city traffic while used to rural sites), not enough knowledge of the traffic rules and informal laws, or, the driver involved in an accident indicates that he/she "does not have enough experience". The analysis for this factor was performed by CIDAUT, using the inclusion criteria according to their database.

The factor "medical condition" was skipped due to lacking data material, mixing of acute medical event with chronic or constant medical condition in the databases (as required for the trip-level), and low frequencies of prevalence in databases.

Factors from the VEHICLE component were already seen to be of lower impact in the accident material provided by the TRACE Partners in task 3.1. However, out of general interest, the attempt of analysing "vehicle condition/maintenance" was undertaken.

"Vehicle condition /maintenance" refers to all states (not actual and dynamic conditions) concerning the vehicle that contributed to an accident occurrence, e.g.: low tyre pressure or low profile, any existing defects of brakes, steering, suspension, cracks in windscreen, no wiping water, etc., that are not suddenly occurring (like an acute tyre blow-out) but are known when starting the trip.

Factors from the ENVIRONMENT component with need for in-depth analysis are "road condition and layout". "Road condition" on the trip level refers to the road construction and equipment state and maintenance and is not to be confused with the road surface condition (like ice/snow/mud) on the driving task level. Two partners used different inclusion criteria according to their databases.

"Road condition" according to the analysis performed by BASt refers to all states (not actual and dynamic conditions) concerning the road that contributed to an accident occurrence, e.g.: narrow road, state of surface (potholes), bend, state or absence of signs or signals, defect/dim lighting, grooves in connection with rain, irregular condition of traffic signs, insufficient lighting, insufficiently secured railway crossings or other constant road conditions.

"Road geometry/layout" according to the analysis performed by VSRC refers to the road geometry (i.e. bend, narrow road, steep road) when this was a contributory factor in the accident. Cases included in the sample cases where road layout was thought to have affected the road user’s control of their vehicle were i.e. cases where the road user’s vision of the road was affected by the road layout.

3.2 "Statistical Method" and used databases

The "Statistical Method" of analysing the above mentioned factors is based on the idea of comparing accidents that are influenced by the trip-related factor of interest with those accidents where this factor had not been contributing to the accident. The question is if the accidents differ from each other.

The differences can be described by explanatory variables which comprises road users characteristics and their participation in traffic, crash types, vehicle characteristics, manoeuvres, situations, locations, times, scenarios, and other characteristics describing or being connected to an accident.

At first the databases are prepared to assign a dichotomised variable to each accident indicating, if in this accident a certain trip-related factor was contributing to the accident or not.

These accidents are then compared by the help of explanatory variables (e.g. by cross tabulation) to see if not negligible associations exist between a contributory factor and an explanatory variable. The selection of explanatory variables in the first was either performed by mutual information method (BASt), or by the given limited number of available variables and expert knowledge (TUG, CIDAUT, VSRC). For detailed method see Internal TRACE Report – Collection of sub-reports relating to task 3.3.

After this screening the explanatory variables that show associations and are not correlated with each other (intracorrelation of explanatory variables) are used for modelling a logistic regression model.

The remaining variables in this logistic regression model for accidents with the contributing factor of interest compared to accidents without this contributing factor, describe a certain pattern that goes along with this type of accident, but not for accidents, where this factor was not contributing.

The method can be regarded as an induced exposure method. This method was chosen in discussion with WP7, as for accident causation factors like e.g. "vigilance" or "road layout" it was assumed that no exposure data will be accessible or at least reliable possible to estimate. This way a risk analysis can be performed for explanatory variables associated to accidents that are caused by certain contributing factors.

Depending on the used database different explanatory variables are at hand for the analysts.

The databases used for this analysis are the ones available to the WP3 Partners BASt (GIDAS), CIDAUT (DIANA), sub-contractor TUG (ZEDATU) and the VSRC (OTS/Stats19).

The analysis of BASt comprises the factors "alcohol", "Vehicle condition", and "road condition". The selection of analysed cases is restricted to passenger car accidents.

The analysis of CIDAUT comprises the factors "vigilance", "experience", and "vehicle condition".

The analysis of TUG comprises the factor "alcohol". The analysis is restricted to fatal accidents.

The analysis of VSRC remains on the first stage without logistic regression modelling and comprises the factors "alcohol" and "road geometry/layout".

3.3 "WP5-method" and used databases

The method introduced by WP5 is an in-depth method of analysing cases from a human functional failure approach. In task 5.3 typical failure generating scenarios are presented showing that combinations of conflicts, tasks and explanatory elements go along with typical functional failures and with typical accident situations. This in-depth approach gives important insight to underlying causes for accidents, and therefore answers to drivers' needs and prevention measures.

Human functional failures can happen due to psycho-physiological and cognitive restrictions on the stages perception, diagnosis, prognosis, decision and execution of an action or on an overall level.

This analysis is in use by INRETS, which contribute to the analysis of the trip-related factor "vigilance".

This method is applied on their own database (OTS) for the first time by VSRC on the factors "alcohol" and "road geometry and layout".

3.4 Data request 3B to WP8

The second request for in-depth data by WP3 from databases as provided by the Partners of TRACE and represented in WP8 will in the following be referred to as "data request 3B". This request aimed at screening for certain associations between contributing factors and explanatory variables. Therefore cross tabulations of the selected contributing factors with a selection of explanatory variables with suggested parameter values was requested.

Only partners being able to provide at least a few of the suggested contributory factors and being able to perform this cross tabulation on a database structure level where only one participant (in one vehicle) for one factor in one accident can be regarded without major effort in database preparation were contacted.

According to the WP3 point of view the data request was not restricted to certain road users or situations, further the data should comparably be from 2004 if possible.

The selected contributing factors were "alcohol", "vigilance", "experience", "vehicle condition", and "road layout" from the trip level (as defined in chapter 3.1).

The selected explanatory variables and the suggested parameter values comprised

a) person’s characteristics:

- Gender (male/female)

- Age group (<25/25-44/45-64/>65)

- occupation (worker, employee/student/pensioner/unemployed/other)

b) traffic participation

- Vehicle group (Car, Van <3.5t/truck >3.5t/PTW/pedestrian/bicycle/Other)

c) accident characteristics

- impact type multiple vehicle collision (frontal/side/rear/Other)

- crash type single vehicle (running off the road/hitting object (immobile)/hitting object (mobile -e.g. animal)/rollover)

- manoeuvre (going straight/overtaking/turning/crossing/merging/other)

d) site characteristics

- Location (Rural/Urban)

- Road type (Autobahn, Motorway, National road/Country road/Other roads)

- Speed limit zone (<50/50-100/>100 km/h)

e) time characteristics

- light conditions (dark/dusk, dawn/day)

- time of day (0-7:59/8-15:59/16-23:59)

The method of the data request is comparable to the first simple step of the statistic method applied by the WP3 Partners except that the explanatory variables are not selected by statistical methods or expert knowledge, but are requested.

For harmonization reasons only these variables were requested, as most databases will be able to provide this information. Due to the restriction to aggregated data only the cross-tabulations were requested in the induced exposure mode comparable to the very first stage of the in-depth analysis performed by the WP3 Partners. However, of course neither statistic testing or even logistic regression nor case analysis was possible to request.

The calculation of risk measures is explained in the Annex 1 and provides the advantage that not absolute frequencies that will vary between in-depth and national databases have to be compared, but a screening for associations between contributing factors and objective findings can be performed.

Replies were received from Czech Republic (national database – further called "Czech national"), France (in-depth EDA databases, further called "INRETS" and "LAB"), Germany (national database – further called "BASt", and in-depth GIDAS database – called "GIDAS"), Great Britain (in-depth OTS database – called "OTS"), Italy (in-depth database SISS - further called "ELASIS"), Spain (in-depth database DIANA – further called "DIANA").

4 Results

The following summaries for the analysed factors present first the in-depth results as provided by the WP3 Partners and presented in their sub-reports. These will be available in a separate Internal TRACE Report. Second, the analysis and the results from the data request 3B will be presented. Thirdly the differences and consensuses will be discussed.

4.1 Summary for Trip-related factor "Alcohol"

4.1.1 Results of WP3 Partners analysis of the contributing factor alcohol

BASt – in-depth German data (GIDAS): passenger cars only, Factor alcohol, 6621 cases, 1999-2005

As human factor contributing to trip related accidents alcohol was selected. For this factor mainly variables regarding circumstances of the trip like infrastructure or time were correlating to this factor. As alcohol is a factor of the human component it was expected to find explanatory variables from the human component to be connected with this factor.

This hypothesis was confirmed by the analysis. Gender (male) and profession (unemployed) were found to be significantly overrepresented in the group of accidents were the factor alcohol was contributory, and accidents involving pensioners were underrepresented. However, this does not give any information on a possible causal relationship between unemployment and alcohol related accidents.

But also environmental variables on the time seem to be relevant in alcohol accidents. Accidents during weekend and night hours are significantly overrepresented. The purpose of journey which was found to be leisure in the majority of alcohol accidents is directly connected to these accidents circumstance as leisure accidents on the weekend at night represent a typical type of alcohol related accidents.

Another variable which seems to have great importance in alcohol related accidents is speed. High original velocity was overrepresented in alcohol related accidents based on both bivariate and logistic regression analysis. This is also true for ‘unadapted speed’ as accident causation. This shows that in alcohol related accidents the driver seems to have problems choosing the appropriate speed, which results in an accident.

For many variables the results from the bivariate analysis were confirmed by the logistic regression analysis. This was also true for the variables regarding human component, time and purpose of alcohol related accidents.

Some other variables showed to be not significant anymore in alcohol related accidents based on the logistic model although they seemed to be relevant on significant level in the bivariate analysis. During the analysis of factor alcohol the variables on infrastructure (traffic control, scene of accident) were not relevant based the results from logistic regression. The results of bivariate analysis suggested that alcohol related accident at scenes without traffic control at straight parts or bend are overrepresented. Crossing and turning accidents are underrepresented as well as accidents involving pensioners.

The analysis of the factor alcohol showed that typical accident circumstances and person characteristics were overrepresented in alcohol related accidents compared to the accidents where alcohol was not involved. The typical alcohol related accidents seem to occur on weekends at night hours. The driver is typically male and the purpose of the trip is “leisure”. These include the stereotypical alcohol related accidents which occur when young people during the weekend drive home after alcohol consumption at a discotheque or party.

Although the database provides a multitude of variables describing vehicle characteristics and further accident circumstances, it was not found, that alcohol related accidents are somehow better explainable by more variables or typical for more specific scenarios and situations.

TUG – in-depth Austrian data (ZEDATU - fatalities only): only male drivers, Factor alcohol, 655 cases, 2003

In Austria 514 fatal accident cases were collected from the year 2003. Five percent of the 801 traffic participants involved were impaired by alcohol. Due to the low number of female drivers under the influence of alcohol, they were not included in this study. Vehicles such as bicycles or railway vehicles were not considered. Excluding these vehicles and the gender group "females" dropped the number of participants to 555.

Out of the selection of analysed explanatory variables five variables are connected to the contributing factor "alcohol" forming a pattern to distinguish these accidents from those where alcohol didn't contribute. These variables are vehicle group, engine power, weekday, road type, and lighting condition. They can be associated with fatal accidents in which alcohol was involved in the following ways:

The vehicle group "car / van" is overrepresented in alcohol related accidents whereas PTWs and trucks are underrepresented compared to the whole sample and compared to the accidents without the influence of alcohol. In addition lower motorizations of the cars with engine power groups of up to 60kW and the group of 60 to 120KW are both overrepresented in alcohol-related accidents and the engine power group of >120kW is involved in fatal accidents where alcohol was not a contributing factor only. Alcohol related accidents are more likely to happen on weekends, on other roads than country roads or motorways, during daylight conditions, and are less likely to happen between 8 to 15 o'clock compared to accidents without alcohol influence. The bivariate analysis provided already the information that drivers' age is not associated to the contributing factor alcohol.

The result of the regression model shows that the variable "lighting conditions" can be seen as most significant within fatal accidents in which alcohol is involved. 50% of alcohol related accidents compared to only 22.9% of the accidents without alcohol as contributing factor occur during daylight conditions. The "road type" has the second most importance. These two variables have the highest impact due to the fact that the null hypothesis is rejected also on the significance level of $p<0,05$.

Even if alcohol is a person characteristic it is interesting to find out that vehicle and infrastructure characteristics are associated in fatal alcohol accidents. The bivariate analysis indicated that male drivers are most likely to be involved in fatal alcohol related accidents driving during daylight. Considering the daytime (even if this variable is not included in the model) male drivers are more likely to be involved in fatal accidents driving between 4pm and 11pm. To understand the road type "other roads" it is necessary to take a look at the accident location because this type of road is mostly coded in urban areas. Increasing the monitoring activities by the police with regard to drunken drivers would have the highest impact on urban areas between 4pm. to 11pm.

VSRC – in-depth UK data (OTS): Factor alcohol, 3216 cases, 2000 - 2007

The statistical overview of all cases in the OTS database where alcohol was a contributory factor was able to identify the characteristics of accidents which were found to be more likely in accidents where alcohol was a causation factor. Only a general statistical overview was undertaken and no analysis of the relationship between different types of accident characteristics was undertaken, as the main analysis undertaken in this work was using the WP5 methodology on a sample selected out of the 245 cases where alcohol was a causation factor. However, from the analysis undertaken, the following accident characteristics (explanatory variables) were found to be significantly more related to accidents where alcohol impairment was a causation factor:

The results of the statistical overview revealed that alcohol impairment was more likely to be causative on minor, urban, single carriageway roads with low density traffic at night, involving just one car or a car and pedestrian (either of which could be the alcohol impaired road user), the driver being male, with the driver not undertaking a manoeuvre, but going ahead on a bend.

The results of the case analysis by the WP5 method on a selection of the alcohol related accidents in this material (OTS) show additional information. The following tables give an overview on the scenarios and further contributing factors found by the WP5 method for the primary (table 4-1) and non primary road users (table 4-2).

short-cut: scenario	**Prototypical scenarios and Human functional failures for primary active road users in accidents where alcohol was contributing**	**Most frequent Factors contributing to the failure occurrence (HUMAN and ENVRIONMENTAL)**	
T1C	Erroneous evaluation of a bend difficulty in a context of 'playful driving'	User behaviour - Risk taking (speed) User state - In a hurry User state - Emotional User behaviour - Risk taking (vehicle positioning) User behaviour - Risk taking (traffic control)	Road geometry Traffic condition – speed
T2B	Erroneous evaluation of a merging gap connected to the low attention paid to the manoeuvre		
T4B	Mistaken understanding of the other's manoeuvre related to their ambiguous signals		
G2B	Alteration of guidance capacities		
D2P	Deliberate violation of a safety rule (i.e. risk taking) when pedestrian is crossing the road		
G2P	Alteration of sensorimotor cognitive capacities, which affected the pedestrian to such a level, it prevented them from either being able to keep on the pavement (e.g. fell into road) or check for traffic adequately before crossing the road		
T2X	Misjudging speed of traffic ahead (and therefore the size of the gap ahead) when on a straight road/or approaching intersection		

Table 4-1: Failure generating scenarios for alcohol related accidents – primary active involved party

scenario	**Prototypical scenarios and Human functional failures for primary active road users in accidents where alcohol was contributing**	**Factors contributing to the failure occurrence (HUMAN and ENVRIONMENTAL)**	
P1C	Road user surprised by a pedestrian (or two-wheeler) on approach	User state - Right of way status	Traffic condition - other road user Visibility impaired - Vehicle lighting Visibility impaired - day/night Visibility impaired - other vehicle(s) Pedestrian in road
T5A	Expecting a non-priority vehicle not to undertake a manoeuvre in intersection		

Table 4-2: Failure generating scenarios for alcohol related accidents – not primary active involved party

Primary active road users - pedestrians

The number of accidents involving pedestrians who were alcohol impaired, which contributed to the accident occurring, was proportionally high in the small sample of cases. Two main failure generating scenarios were identified for these primary active road users, which related either to the pedestrian taking an intentional risk when crossing the road (more than they normally would if sober), or the pedestrian being so alcohol impaired they are not totally in control of their cognitive and physical capacities, so are unable to judge whether it is safe to cross the road or even able to control the direction they are going.

The analysis shows that, when alcohol impaired, pedestrians in the scenarios shown here can be just as much of a hazard to themselves as car drivers and unfortunately, when in a collision with a vehicle on the road, it will always be the pedestrian who ends up worse affected.

The simplest way technology can help to avoid accidents with alcohol impaired pedestrians is by introducing a system into vehicles which helps to detect errant pedestrians and also assist the driver to avoid a collision with them (or reduce the severity). Education could also help pedestrians be more aware of the dangers they face when trying to cross the road when alcohol impaired.

Primary active road users – motor vehicles

For primary active motor vehicle driver/riders, it was found that not one type of failure generating scenario was by far the most frequent in the sample of cases where alcohol impairment was a causation factor. Therefore, alcohol impairment can affect a road user at all stages in the driving process, from the initial detection of potential hazards through to when taking action.

Also, undoubtedly depending on the level of impairment, alcohol can also affect the road user in very subtle ways (i.e. can be just as contributory as other factors), but also in more blatant ways (i.e. the accident would not have occurred if the road user was not alcohol impaired).

By installing a mechanism in a motor vehicle that stops the driver/rider from being able to use their vehicle at all if alcohol is in their system (or at least over the legal limit), this would reduce the likelihood of alcohol impaired drivers on the road, in addition to the more traditional ways such as education and police enforcement.

Non-primary active road users

For the non primary active road users in alcohol impairment accidents, it was their failure to detect the conflict in the first place that led to the accident occurring in the majority of cases, mainly as a result of restricted visibility. Overall, in most cases, the scenario involved the non primary active road user thinking there was no reason to change their driving task or be more cautious, either because they did not detect a potential conflict (detection failure) or they did not expect another road user in plain view to become a 'conflict' (prognosis failure), caused by their 'rigid attachment to the right of way status', until it was to late to avoid.

Advance warning devices may assist in warning a potential non primary active road user of a potential conflict ahead, either in plain view or out in view, and therefore help to avoid a collision, plus control systems such as ESC and ABS.

The following table 4-3 shows an overview of the findings of the in-depth analysis of the WP3 partners on the factor alcohol. The suggested "potential solution" is given as a plausible consequence from the findings, but cannot provide any effectiveness estimation. One obvious way to prevent alcohol related accidents is e.g. by preventing the trip-related factor in the first by alcolock key systems. However, no recommendation can be given here, as the effectiveness of this system is analysed in WP4.

Factor	Partner	Method	Main question	Result	Potential Solution In addition to "alcolock"
Alcohol	BASt	Logistic Regression	Circumstances and person characteristics of alcohol related accidents	• Male ↑↑ • Unemployed↑↑ • Weekends↑↑ • Leisure trips↑↑ • Leaving road accidents↑↑ • Pensioners↓ • Crossing and turning accidents↓	More frequent alcohol controls during typical hours of alcohol related leisure trips on weekends
Alcohol	TUG	Logistic regression	Which explanatory factors are associated with alcohol?	vehicles/vans↑ higher motorization↑ weekend↑ daylight↑ other roads↑	Efficient monitoring by police during 4 to 11 p.m. on urban roads, in addition on weekends on specific points
Alcohol	VSRC	General statistical overview	Which explanatory variables are more often associated with alcohol?	Human • Male drivers Participation • Single car • Car v pedestrian • Car drivers • Pedestrians Accident • Frontal impacts • No manoeuvre Environment • Night (darkness) • Urban • Minor • Single carriageway • Low speed limits • Bends • Light density traffic	More stringent police enforcement (i.e. stopping and testing car drivers) during darkness on minor urban roads, in particular during quieter times.
Alcohol	VSRC	In-depth analysis sample of cases using WP5 methodology	What are the most typical failure generating scenarios in accidents where alcohol impairment was a cause?	**Primary active (drivers)** – No one specific scenario. Alcohol contributes mainly to diagnosis or decision making failures or is main cause of an overall failure. **Primary active (pedestrians)** – D2P: Deliberate violation of a safety rule (i.e. risk taking) when pedestrian is crossing the road, G2P: Alteration of guidance capacities, further:. Same failures as above. **Non-primary active** – P1C: Road user surprised by a pedestrian (or two-wheeler) on approach, T5A: Expecting a non-priority vehicle not to undertake a manoeuvre in intersection; Mainly detection failures.	In addition to car drivers, better road safety education for pedestrians when out at night and alcohol impaired. Pedestrian detection & avoidance systems in vehicles.

Table 4-3: HUMAN Trip-related factor: alcohol

4.1.2 Results of the analysis of the data provided by the WP8 Partners of the contributing factor alcohol

Data had been provided by "INRETS" (France, in-depth), "Czech National" (Czech Republic, national), "OTS" (UK, in-depth), "GIDAS" (Germany, in-depth), "BASt" (Germany, national), "DIANA" (Spain, in-depth), "LAB" (France, in-depth), and "ELASIS" (Italy, in-depth).

As explained in Annex 1 the cross tabulations of alcohol related accidents and not alcohol related accidents with explanatory variables from the fields "person characteristics", "traffic participation", "accident characteristics", "site", and "time" were screened for relevant associations by comparing the relative representation of the explanatory variables in the two accident groups (with/without alcohol as contributing factor) first.

On this basis the calculation of Odds Ratios (OR) with 95% Confidence Intervals was performed to find significant correlations between explanatory variables and the contributing factor alcohol.

The detailed results are pictured in Annex II.

From the person characteristics it can clearly be stated that male gender is typically found in alcohol related accidents (Odds Ratios between 2.1 and 3.9 for UK, Italy, Czech Republic, France, and Germany). The age group of 25 to 44 years old is clearly overrepresented in alcohol related accidents for INRETS and BASt (increased chance of 40%), and the age group of older than 65 years old is underrepresented in the Czech alcohol related accidents (70% decreased chance compared to other age groups to be involved in alcohol related accidents). No specific age group is dominating alcohol related accidents in other databases. Only 4 databases provide information on the occupation, and the only significant result is found in the GIDAS database for an overrepresentation of unemployed persons being involved in alcohol related accidents (OR 8). A tendency in the same direction is seen for the INRETS results, but INRETS, DIANA, and the LAB data cannot prove any significant association between a certain occupation and the involvement in accidents where alcohol was a contributing factor.

From the traffic participation data it is found that in the German and Czech data especially bicycle riders are more often involved in accidents where alcohol was contributing compared to other accidents (OR 1.9 to 2.7). Also pedestrians were found to be overrepresented in alcohol related accidents as found in the GIDAS and the OTS data (OR 2.8 and 2.5). Only ELASIS finds a significant over-representation of car and van <3.5t drivers (OR 2.7) to be more often involved in alcohol related accidents than in other types of accidents.

From the accident characteristics only in the BASt data an overrepresentation of frontal (frontal-frontal) impacts is found for alcohol related accidents (OR 1.9). GIDAS, Czech and ELASIS find an overrepresentation of accidents other than frontal, side or rear impacts (OR 2.5 to 3.2). A tendency for rear end impacts is seen in the DIANA data, but no significant association is found. In single vehicle accidents typically for alcohol related accidents compared to accidents where alcohol was not contributing, "running off the road" is found in the BASt, Czech, and LAB data (OR 1.3 to 2.5). Also in the Czech data and further only for the ELASIS data an overrepresentation of hitting immobile objects is found (OR 2.2 to 3.1). The OTS finds rollover accidents to be typical for alcohol related accidents compared to not alcohol related accidents (OR 2.1). The manoeuvre more often seen in accidents where alcohol was contributing is usually "going straight" (ELASIS, GIDAS, LAB, OR 1.6 to 3.8) and "going around bend" as specific part separated from "going straight" in the OTS data (OR 2.9). Only DIANA finds overtaking to be more typical for alcohol related accidents than other accidents.

The place for alcohol related accidents compared to other accidents is found to be rural in three databases (Czech, BASt, ELASIS, OR 1.1 to 1.7), the other databases don't find a significant domination of either rural or urban site for alcohol related accidents. The road type is also only found in four databases to show significant associations with an under-representation of autobahn, national roads or motorways (BASt, OR 0.8) and on overrepresentation of country roads (GIDAS, OR 1.5) and of other roads (Czech, ELASIS, OR 1.6 and 2.2). The only database showing that alcohol related accidents are occurring in certain speed limit zones is the BASt data with an over-representation of 10% of zones with a speed limit of lower than 50km/h. A tendency for the same direction of overrepresentation, but not reaching significance is also seen in the OTS and LAB data.

The time of the day and the light conditions show that alcohol related accidents are over-represented in dark light conditions (OR 4.3 to 9.9) and in the time between 16:00 and 8:00 o'clock (3.4 to 11.6), except for the DIANA data, that cannot show any significant association between time of day or light conditions with alcohol related accidents compared to not alcohol related accidents.

4.1.3 Summary, Discussion and Conclusion of the analysis of the contributing factor alcohol

Alcohol as contributing factor refers to all information available indicating that influence of alcohol was present during the trip. Enough evidence for an increased risk for crashes exists when being under the influence of alcohol. In addition an interaction between alcohol and being of young age due to physiological tolerance characteristics is known, see also D3.1.

By review of literature, risk estimates were found to increase the chance for being involved in an accident for alcohol intake at any level, with increases of 3 up to 80 times the risk when not impaired by alcohol.

From task 3.1 it was concluded that alcohol contributed to accidents in up to 19% of the accidents covered by the databases available to the TRACE Partners.

From the analysis of the first data request to WP8 by WP3 (data request 3A) further it can be seen that alcohol is overrepresented as contributing to accidents compared to other contributing factors in eight databases available to the TRACE partners by factors between 1.1 and 6.9. In fatal accidents alcohol is overrepresented in 10 databases with factors between 1.3 and 9.4.

In task 3.3 it was found that typical patterns for alcohol related accidents can be defined and that alcohol related accidents differ from accidents where alcohol didn't contribute in various variables.

As summary from the WP3 Partners in-depth statistical analysis the following table 4-4 presents the pattern found.

Of more importance and as criteria for selection of the explanatory variables request to WP8 it has to be kept in mind that although a multitude of in-depth data had been screened for associations, only those presented remained in the model for characterizing alcohol-related accidents.

parameter values representation for alcohol	GIDAS (Germany in-depth) Passenger cars only	TUG (Austria in-depth) Fatal accidents, males only
Pattern: variables included in the logistic regression model	Male ↑↑ Unemployed↑↑ Pensioners↓ Weekends↑↑ Leisure trips↑↑ Leaving road accidents↑↑ Crossing and turning accidents↓ Traffic control regulated ↓ Road network straight or bend ↑ Road network traffic node ↑ original velocity >30 km/h↑ unadapted speed ↑	vehicles/vans↑ higher motorization↑ weekend↑ daylight↑ other roads↑

Table 4-4: Results of the statistic analysis by the Partners in task 3.3 for factor alcohol

From data request 3B from WP8 it is also found that circumstances associated to alcohol related accidents in comparison to accidents to which alcohol was not contributing exist in other databases available to the TRACE Partners.

More frequently found in alcohol related accidents compared to other types of accidents are males, age group 25 to 45, unemployed people, pedestrians and bicycle riders, frontal impacts and other types than frontal, side or rear impacts, further running off the road accidents, rollovers, and accidents by hitting immobile objects, while going straight, going through a bend and while overtaking, usually not on motorways/autobahn, in speed limit zones of lower velocities (inner city limits), during darkness and usually not during 8 and 16 o'clock.

As summary from statistic analysis of the WP8 replies the following table 4-5 presents the Databases that show significant bivariate associations for explanatory variables with alcohol related accidents.

explanatory variables	parameter values representation for alcohol	Czech national	BASt (Germany national)	GIDAS (Germany in-depth)	INRETS (France in-depth)	LAB (France in-depth)	OTS (GB in-depth)	DIANA (Spain in-depth)	ELASIS (Italy in-depth)
person	**Male ↑**	Czech	BASt	GIDAS		LAB	OTS		ELASIS
	>65 ↓↓	Czech							
	25-44 ↑		BASt		INRETS				
	Unemployed ↑↑			GIDAS					
traffic participation	Car, Van, <3.5t ↑								ELASIS
	Bicycle ↑	Czech	BASt						
	Pedestrian ↑ and Bicycle ↑			GIDAS					
	pedestrian↑						OTS		
accident (impact and manoeuvre)	frontal↑		BASt						
	Other impact type↑	Czech		GIDAS					ELASIS
	hitting object (immobile) ↑	Czech							ELASIS
	rollover↑						OTS		
	running off the road ↑		BASt			LAB			
	going around bend↑						OTS		
	going straight ↑			GIDAS		LAB			ELASIS
	Overtaking ↑							DIANA	
place	Rural ↑	Czech	BASt						ELASIS
	Autobahn, National road↓		BASt						
	Country road ↑			GIDAS					
	Other roads ↑	Czech							ELASIS
	<50 km/h ↑		BASt						
time	dark ↑	Czech	BASt	GIDAS	INRETS	LAB			ELASIS
	8-15:59 ↓↓	Czech	BASt	GIDAS	INRETS		OTS		ELASIS

bold: found also in logistic regression model, *italics*: indirectly confirming logistic regression model

Table 4-5: results from the data request 3B replies calculations - parameter values showing associations with alcohol related accidents (not multivariate)

The logistic regression analysis of the factor alcohol by BASt (GIDAS database, Germany, only passenger cars accidents) and TUG (ZEDATU database, Austria, fatal accidents of male traffic participants) showed that typical accident circumstances and person characteristics were overrepresented in alcohol related accidents compared to the accidents where alcohol was not involved. The typical alcohol related accidents seem to occur on weekends and night hours. The VSRC (OTS database, UK in-depth) analysis adds light traffic conditions to the night time conditions. In contrast the TUG analysis on fatal accidents finds weekend dominating as well, but daylight conditions to be overrepresented. The difference will most probably explained by the fact that TUG analysed fatal accidents only. If alcohol was a contributing factor fatal accidents might more typically occur during daylight after 16:00. During darkness fatal accidents with male participants might not that much differ in characteristics compared to other contributing factors than alcohol. Night hours and darkness is also overrepresented in the databases of Czech, GIDAS, OTS, BASt, INRETS, and LAB. The time between 8 and 16 was comparably underrepresented in the databases of INRETS, OTS, Czech national, BASt national and GIDAS.

The driver is typically male and the purpose of the trip is “leisure”. The TUG and the VSRC confirm the male overrepresentation. From the data request 3B it can be derived that male gender is also found to be overrepresented in alcohol-related accidents in the databases of OTS, Czech national, GIDAS, BASt national, ELASIS, and LAB.

Crossing and turning accidents are underrepresented in the BASt analysis like comparably to all other databases, but only the national data in Germany and LAB also find an overrepresentation of leaving the road accidents. The non adapted speed and an original velocity of higher than 30km/h at impact needs in-depth reconstruction information and was not requested from WP8, further traffic regulation and road network was not requested. But also as an indicator the speed limit zone shows an association in the national BASt data of lower than 50km/h zones, the OTS finds speed limits of 30mph/48kph and minor roads to be overrepresented, but the other databases didn't show any association between alcohol related accidents and speed limit zones. Going round a bend and going straight as found by the OTS, and the GIDAS, LAB and ELASIS is comparable to the site of road network straight or bend from the WP3 analysis.

Except for speed limit zones that might show differences for alcohol related accident sites in Europe, there are indications, that the pattern found by BASt might be valid in the other countries as represented by the data providers for WP8. If this pattern is applicable to an accident then the contributing factor alcohol was very likely present.

Unfortunately usually the case numbers for the data from Spain are too low to show significant associations.

The analysis of the factor alcohol by TUG (ZEDATU database, Austria, restriction to fatal accidents of males only) showed further an overrepresentation of the vehicle group (vehicles/vans) and a higher engine power (higher motorization). This mode of traffic participation is found by only one other database of the data request 3B (ELASIS), but more often bicycles and pedestrians were overrepresented, if vehicle group showed an association with alcohol-related factors at all (databases Czech, GIDAS, BASt: bicycles; GIDAS and OTS: pedestrians). The VSRC can show single car and car vs. pedestrian crashes to be overrepresented.

The road type "other road" as found by TUG was also overrepresented in the Czech and Italian database, and highways and country roads were comparably underrepresented in Germany. In addition the VSRC analysis shows single carriageway roads to be overrepresented.

The location urban to be overrepresented in the VSRC results was found in no other database, but rural was overrepresented in the Czech, Italian, and German data.

The VSRC analysis showed that alcohol related accidents happen to occur more often in bends, leading to frontal impacts where no manoeuvre was undertaken. The Czech and GIDAS databases show other types (other than frontal, side, rear) to be overrepresented, whereas the German national data also showed frontal impacts (frontal-frontal) to be more connected to alcohol-related accidents. No specific manoeuvre and going round a bend from the OTS analyses is comparable to "going straight" in the GIDAS, LAB, and ELASIS data.

The statistical in-depth analysis of the WP3 partners is able to show that alcohol related accidents are not typical for a certain age group, which cannot be seen when only regarding the cross tabs results. Especially the BASt analysis for WP3 on passenger car accidents from the GIDAS sample is able to provide a typical pattern connected to the contributing factor alcohol in comparison to other contributing factors related accidents, because of their selection method by Mutual Information content and the multitude of available data and variables.

By this comparison it can be assumed that the pattern found by BASt for passenger car accidents might hold for other EU countries as well, but this cannot be proven. The pattern found by TUG on fatal accidents might also apply to fatal accidents caused by alcohol in other EU countries, but again, a definite prove cannot be assumed.

The in-depth results from case analysis by WP5 method as performed by the VSRC revealed that there was not one typical failure generating scenario for the road users who were alcohol impaired in the accidents. However, from the accidents analysed, it was found that alcohol impairment can affect a driver's or pedestrian's ability to correctly judge the road ahead and also make the correct decisions while driving/attempting to cross the road. Alcohol impairment was also found on occasions to be the overriding factor in the accident (i.e. if the road user was not impaired by alcohol, there would have been no functional failure and the accident would not have occurred).

User behaviour, road geometry and speed show to be contributing to the primary active road users' failure, which is usually an alteration of sensorimotor functions and cognitive capacities, erroneous evaluations of bends, gaps or of other road users behaviours, and often risk taking behaviour has to be assumed. This is in line with the statistics results of leaving the road accidents and speed that seems to be connected to alcohol related accidents. Here in addition it can be stated that this is due to failures in diagnosis or decision or because of an overall failure. For pedestrians as primary active road users in alcohol related accidents it has to be stated that often deliberate violation of a safety rule has to be assumed.

For the non primary active road user involved in alcohol related accidents often visibility (of the active road user) plays an important role in contributing to the accidents occurrence. The failures of "Expecting a non-priority vehicle not to undertake a manoeuvre in intersection" or "Road user surprised by a pedestrian (or two-wheeler) on approach" shows a tendency for the fact, that the primary active road user performed unforeseeable actions that were not possible to see (visibility) or predict from the opponents point of view and the accidents therefore hardly to avoid. Newer vehicle safety systems might be able to provide the necessary information earlier or lead to (automated) actions before the non active road user was able to perform them.

The VSRC database analysis shows that many bivariate associations hold also for the other countries as represented by the TRACE WP8 Partners, especially for France and Germany. Therefore the results of the case analysis by the WP5 method might most probably be transferable.

4.2 Summary for Trip-related factor "vigilance"

4.2.1 Results of WP3 Partners analysis of the contributing factor vigilance

INRETS, in-depth data (EDA), France (usually no fatal accidents covered in database): factor vigilance, 1,106 accident cases, 1999-2007

Vigilance stands for a level of efficiency of the central nervous system needed to carry out a task. A certain level of vigilance, not too low nor too high, is indeed a prerequisite to carrying out all of the cognitive functions at play in the driving task. Several factors may alter the level of vigilance: fatigue (professional, psychological), psychotropic substances (medication, cannabis, alcohol, etc.), irritation, stress and age. Thus, the driver's vigilance problems, related to one or more of these factors, contribute to the production of 20% of the cases in the bodily injury accident in-depth database studied (comprising 1,106 accident cases involving 1,890 drivers).

Breakdown in vigilance usually leads to an overall failure in the individual (60% of our sample of 225 drivers). In driving, the repercussions of these effects are diverse (falling asleep, faintness, inability to guide the vehicle) and can occur in the simplest driving tasks, leading to a loss of vehicle control. Drivers are then unable to ensure the simplest driving tasks, i.e. guiding the vehicle along a straightaway (11.3% of the cases) or follow a trajectory (14.4% of the cases). In this type of cases, three main categories of drivers can be distinguished: - rather young drivers (28 and 31) who had consumed alcohol or cannabis in a rather festive context, -older drivers (37 to 41) for whom alcohol consumption is chronic (in these cases, alcohol consumption is often accompanied by major fatigue or the use of medication (antidepressants, hypnotics, etc.)) and - elderly people for whom cognitive slowdown and fatigue affected overall cognitive abilities. Thus, the results of this study confirm that excessive alcohol consumption, medication or fatigue usually lead to an overall loss in sensorimotor and cognitive abilities. Based on this methodology, the results of this study confirm that excessive alcohol consumption, medication or fatigue usually lead to an overall loss in sensorimotor and cognitive abilities. In driving, the repercussions of these effects are diverse (falling asleep, faintness, inability to guide the vehicle) and can occur in the simplest driving tasks, leading to a loss of vehicle control. In this type of cases, three main categories of drivers can be distinguished: - rather young drivers (28 and 31) who had consumed alcohol or cannabis in a rather festive context, -older drivers (37 to 41) for whom alcohol consumption is chronic and - elderly people for whom cognitive slowdown and fatigue affected overall cognitive abilities.

The alteration of vigilance state also affected information processing, decision-making and execution, sometimes in a paradoxical way involving excitation. An impaired level of vigilance notably affects information processing leading certain drivers to misevaluate a driving parameter. Usually, in a playful context, these drivers underestimate the difficulty of a bend. Alcohol consumption or serious fatigue, combined with excessive speed and risky driving, are the main explanatory elements for this failure. An alteration in the level of vigilance can also affect decision-making abilities. Thus, under the influence of alcohol or irritation, some drivers try to overtake in conflict situations or in situations of reduced visibility. Lastly, a weak level of vigilance can also lead to difficulties in controlling vehicle commands and managing disturbances. Often, these drivers, who consume alcohol or are tired, drive too fast and in an excessively risky manner given the outside conditions or the state of the car. When they encounter a more or less foreseeable external disturbance, these drivers lose the control of their vehicle.

Thus, we most often observe in subjects with deficient vigilance both an absence of processing of certain information from the road scene and longer processing time accompanied by errors in diagnosis, in decisions or in execution. Usually, vigilance problems lead to failures in all of the individual’s cognitive functions, making the driving activity impossible.

Vigilance problems in accident occurrence encompass a certain variety of factors which cannot be reduced to sleepiness, as usually considered in many studies. All these factors are prone to combine with each others and with environmental factors, resulting in an even more complex problematic. It has been noticed that elements related to vigilance impairment not only cover reduced states of vigilance (fatigue, drowsiness…) but also overexcitement which can be seen as a "too high" or anyway inappropriate, disrupt level of vigilance (stress, excitement, anger, etc.). When overall distinguished, the factors representing those two poles belong more widely to the hypovigilance domain (75.1%) whereas overexcitement is observed in 23.3% of the cases.

In the frame of the TRACE project, the interest into differentiating between the different forms under which vigilance problems lead to accident occurrence relies in finding the means more or less appropriate to counteracting such or such human failure producing scenario. Solutions can't be the same to resolve, for example, a drowsiness occurring on a monotonous straight road and an impaired level of vigilance resulting in a poor evaluation of the speed for negotiating a bend, etc.

Some of these problems coming from vigilance impairment are able to be addressed with the resort of electronic safety functions, such as "Drowsy Driver Detection System" (DDS) or "Alcolock Keys" (AK) in a more or less efficient way depending on the variables interacting in the malfunction process (cf. TRACE deliverable D4.1.5).

Other accident prototypical accident scenarios linked with vigilance defects would appeal to complementary measures intervening beforehand the actual driving activity to prevent the vigilance problem to occur (such as training, information, enforcement, etc.).

The detailed results presented in the Sub-Report in the INTERNAL TRACE Report – Collection of Sub-reports for task 3.3 allow identifying different vigilance-related sources of risk for which specific countermeasures should be put forward.

In the following table 4-6 the most frequently occurring single scenarios are pictured (higher than 4% of the vigilance related accidents).

scenario	**Human functional failures and Prototypical scenarios for accidents where vigilance was contributing**		**Refined scenarios**	
G2A	Overall Alteration of abilities (G2) - Keeping the trajectory (bend)	14.4%	Playful consumption of alcohol (I)	9.7%
			Chronic consumption of psychotropic drugs (II)	4.7%
G2B	Overall Alteration of abilities (G2) - Guidance abilities	11.3%	Playful consumption of alcohol (I)	4%
G1A	Loss of psycho-physiological abilities (G1) - Falling asleep	23.2%	Professional fatigue (I)	4.4%
			Long itinerary (II)	4.7%
G1A-bis	Loss of psycho-physiological abilities (G1) – malaise	5.3%		

Table 4-6: failure generating scenarios for vigilance related accidents

CIDAUT, in-depth data (database "DIANA"), Spain

Vigilance as contributing factor that has to be seen as a low level of vigilance caused by alcohol is not regarded here. The results of the analysis of the factor vigilance have to remain on a first stage as logistic regression model did not show significant results. The analysis shows that this trip-related factor is predominantly contributing in accidents that are able to be defined by characteristics from the environment, but it was not possible to attribute typical person characteristics.

The environmental characteristics more associated with vigilance as a contributing factor, are the following ones: intersection, time of accident, road type, luminosity and speed limit. The categories more probably associated with the presence of vigilance as a contributing factor are: no intersection, time of accident between 22:00 - 8:00, highway, dawn and darkness, and a speed limit between 100 and 120 km/h.

As a specific action, measures related to luminosity, especially in highways could be a clear recommendation. But, the monotony of this comprehensive scenario should be counteracted as overall action. In order to achieve this aim, introducing any change in highways environment could probably affect driver attention. That is why the most accurate performance to counteract the monotony of this scenario might be related to vehicle characteristics.

In that way, the development of Advanced Driver Assistance Systems (ADAS) constitutes nowadays an important field of research, including fatigue-drowsy detective systems and functions related to illumination (e.g. Advanced Adaptive Front Light System; Night Vision systems). This could be a good future line of measures, according to the results observed in DIANA data.

From a psychological point of view, vigilance is related to drowsiness and fatigue. The first is wide influenced by the number of hours slept the same day and days before the trip, as well as by circadian rhythms. An insufficient dream time leads to slow reaction times, information processing deficits, sensorial and perceptive alterations. The last decreases accuracy and speed of answers while driving, and divided attention ability; rises reaction times; and the driver presents high tendency to take risks and higher number of misinterpretations.

All of them are essential abilities on a trip, and are related to accurate health habits. Taking into account that current lifestyle lead people to travel at night or drive without having rested a sufficient number of hours, a measure addressed to human factor is necessary. Educational campaign for drivers may be one of them; probably included in driving licence training and in school curricula, related to road safety education.

A combination of infrastructure, in-vehicle and educational measures should be recommended due to limitations on systems found by Van Elslande et al. (2008) (TRACE deliverable D4.1.5). So, for example, authors showed that the necessity of enough light to detect the cues related to the driver falling asleep, and the drivers motivation related to the journey (strong will to reach their destination) or even their confidence in self-judgement could limit the effectiveness of drowsy driver detection system. Research to improve the safety effectiveness of these functions should be promoted, taking into account their usefulness for safety. The authors of the aforementioned study (Van Elslande et al. 2008, TRACE deliverable D4.1.5) compile a set of suggestions which could lead future investigation in this way.

The following table 4-7 shows an overview of the findings of the in-depth analysis of the WP3 Partners on the factor vigilance. The suggested "potential solution" is given as a plausible consequence from the findings, but cannot provide any effectiveness estimation. One surprising way to prevent vigilance related accidents is e.g. by preventing the trip-related factor in the first by alcolock key systems, because in a high share of cases limited vigilance is due to alcohol consumption. However, no recommendation can be given here, as the effectiveness of this system is analysed in WP4.

Factor	Partner	Method	Main question	Result	Potential Solution
Vigilance	INRETS	WP5 methodology	▪ Defining operationally the notion of vigilance ▪ Understanding the different facets of the corresponding driving problems ▪ Use of Prototypical Scenarios	▪ Vigilance problems contribute to the production of 20% of the accidents studied ▪ Breakdown in vigilance leads to overall failure (60%of the drivers) ▪ Contexts and factors that pre-condition the accident are determinant to identify adequate scenarios	▪ Results could be used on the angle of safety systems as to analyse drivers' needs and safety benefits of those systems ▪ Focus on the right population and conditions of accidents has to be made in order to address adequate countermeasures
Vigilance	CIDAUT	Crosstabs	Environmental characteristics associated with "vigilance" - related accidents.	o Intersection o Time of accident o Road Type o Luminosity o Speed Limit	- Lighting improvement in highways - Research and development of in-vehicle systems: Advanced Adaptive Front Light System; Night Vision systems Advanced Driver Assistance Systems to warn the driver about driver's state (e.g. Drowsy Driver Detection System) and about driver's behaviour (e.g. Lane Keeping Assistant). - Educational campaign about effects of driving habits related to vigilance.

Table 4-7: HUMAN Trip-related factor: vigilance

4.2.2 Results of the analysis of the data provided by the WP8 Partners of the contributing factor vigilance

Data had been provided by INRETS (France, in-depth), Czech National (Czech Republic, national), OTS (UK, in-depth), GIDAS (Germany, in-depth), BASt (Germany, national), DIANA (Spain, in-depth), LAB (France, in-depth); ELASIS (Italy, in-depth).

As explained in Annex 1 the cross tabulations of vigilance related accidents and not vigilance related accidents with explanatory variables from the fields "person characteristics", "traffic participation", "accident characteristics", "site", and "time" were screened for relevant associations by comparing the relative representation of the explanatory variables in the two accident groups (with/without vigilance as contributing factor) first.

On this basis the calculation of Odds Ratios with 95% Confidence Intervals was performed to find significant correlations between explanatory variables and the contributing factor vigilance.

The detailed results are pictured in Annex II.

From the person characteristics it can clearly be stated that male gender is typically found in vigilance related accidents (OR from 1.7 to 3.1 in the UK, Italian, Czech and German data). The age group of 25 to 44 years old is only slightly overrepresented in vigilance related accidents for the Czech national, German national and Italian data (OR 1.1 to 1.3). No specific age group is dominating vigilance related accidents in other databases. Only 4 databases provide information on the occupation, and the only significant result is found in the GIDAS database for an overrepresentation of unemployed persons being involved in vigilance related accidents (OR 4.2). A tendency in the same direction is seen for the LAB results, but also INRETS and DIANA cannot show any significant association between a certain occupation and the involvement in accidents where vigilance was a contributing factor.

From the traffic participation data it is found that in the German data especially bicycle riders are more often involved in accidents where vigilance was contributing compared to other accidents (OR 2). Also car and van <3.5t were found to be overrepresented in vigilance related accidents as found in the ELASIS and INRETS data (OR 2.6 and 3.5). Only the Czech national database shows a significant over-representation of trucks >3.5t (OR 2.2) to be more often involved in vigilance related accidents than in other types of accidents.

From the accident characteristics only in the BASt data an overrepresentation of frontal (frontal-frontal) impacts is found (OR 2.1) for vigilance related accidents, and also in the DIANA data a tendency for frontal impacts is seen. The Czech and ELASIS data find an overrepresentation of accidents other than frontal, side or rear impacts (OR 2.4 and 2.5). In single vehicle accidents typically for vigilance related accidents compared to accidents where vigilance was not contributing "running off the road" is found in the BASt and LAB data (OR 1.5 to 2.9). Also in the Czech data and further only for the ELASIS data an overrepresentation of hitting immobile objects is found (OR 4.7 and 2.2). The manoeuvre more often seen in accidents where vigilance was contributing is usually "going straight" (ELASIS; GIDAS; LAB, DIANA, OR 1.5 to 13) and "going around bend" as specific part separated from "going straight" in the OTS data (OR 3).

The place for vigilance related accidents compared to other accidents is found to be rural in all databases (significant differences for Czech, BASt, ELASIS, GIDAS with OR 1.4 to 3.6), except for the LAB data showing a significant under-representation (OR 0.6). The road type is predominantly autobahn/motorways national roads in the DIANA and OTS data (OR 1.6 to 5), and country roads in Germany and the Czech Republic (OR 1.1 to 2.4). In Italy other roads than those two types are dominating when vigilance was a contributing factor (OR 2.4). In German and UK in-depth databases show that vigilance related accidents are typically occurring in speed limit zones of higher limits than 100km/h (70MPH) (OR 1.5 and 2.1). A tendency for the same direction of overrepresentation, but not reaching significance is also seen in the INRETS and DIANA data.

The analysis of light conditions show that vigilance related accidents are significantly over-represented in dark light conditions in all data (OR 1.4 to 6.8) except for DIANA with a high tendency for dusk and dawn light conditions. The time between midnight and 8:00 o'clock is overrepresented in all data (OR 1.5 to 8.2) and the time between 16:00 and midnight still is also overrepresented for Italian, German, UK and the LAB data (OR 1.8 to 3.6), but underrepresented for the Czech Republic (OR 0.7).

4.2.3 Summary, Discussion and Conclusion of the analysis of the contributing factor vigilance

Vigilance is describing the arousal state of the human. It is influenced by physiological/medical/biological circumstances, circadian influences, drugs and medicines providing the platform on which appropriate interaction with and reaction to environment, and attention can be realised. Attention can be influenced by motivation, distractibility, concentration potential, psychological reasons (nervousness, excitement) sometimes even pretending a higher than actual vigilance level (at maximum short time lasting by endocrine short adrenaline boosts).

Vigilance refers to all states (not actual and dynamic conditions) concerning the human state of being awake on a normal level (the extremes referring to vigilance would be deep sleep/coma and on the other extreme hyperexcitation) that contributed to an accident occurrence, e.g.: fatigue, under influence of alcohol or narcotics or other drugs and medications, exhaustion and physical fatigue, chronic diseases with restrictions in vigilance, (not to be mixed up with distraction and attention deficits that are possible while being wide awake).

By Literature review no risk estimates were found for being involved in an accident due to being in a low (or high) state of vigilance. This might be because usually this is not measured or documented for studies as being a trip-related factor.

From task 3.1 it was concluded that fatigue and vigilance contributed to accidents in up to 17% of the accidents contained in the databases available to the TRACE Partners.

From the data request 3A further it can be seen that vigilance and fatigue are overrepresented as contributing to accidents in two databases available to the TRACE partners by factors between 1.2 and 1.4. In fatal accidents vigilance/fatigue is overrepresented also in two databases with factors between 1.1 and 2.0. The few databases with this factor more often compared to other contributing factors shows, that this factor on the one hand is not measured and documented at all, but often "falling asleep" is analysed, and, in addition vigilance is difficult to detect as a contributing factor, if not the persons involved in the accident indicate this.

In task 3.3 it was found that typical scenarios for vigilance related accidents can be defined by applying in-depth human functional failure analysis (INRETS) and that vigilance related accidents differ from accidents where vigilance didn't contribute in various variables (CIDAUT).

As summary from the WP3 Partners' in-depth statistical analysis the following table 4-8 presents the bivariate associations found.

It has to be reminded that although a multitude of in-depth data had been screened for associations, only those presented reached significance for characterizing vigilance-related accidents.

parameter values representation for vigilance	CIDAUT (Spain in-depth)
Significant bivariate associations	no intersection ↑ highway ↑ speed limit between 100 and 120 km/h ↑ 22:00 - 8:00↑ dawn and darkness ↑

Table 4-8: results of the statistic analysis by the Partners in task 3.3 for factor vigilance

From data request 3B it is also found that circumstances associated to vigilance related accidents in comparison to accidents to which vigilance was not contributing exist.

More frequently found in vigilance related accidents compared to other types of accidents are males, age group 25 to 45, bicycle riders, rural areas, country roads or highways, running off the road accidents, while going straight (or around a bend), in higher speed limit zones, during darkness and predominantly between 0 and 8 o'clock

As summary from statistic analysis of the WP8 replies the following table 4-9 presents the Databases that show significant bivariate associations for explanatory variables with vigilance related accidents.

explanatory variables	parameter values representation for vigilance	Czech national	BASt (Germany national)	GIDAS (Germany in-depth)	OTS (GB in-depth)	INRETS (France in-depth)	LAB (France in-depth)	DIANA (Spain in-depth)	ELASIS (Italy in-depth)
person	Male ↑	Czech	BASt	GIDAS	OTS				
	25-44 ↑	Czech	BASt						ELASIS
	Unemployed ↑			GIDAS					
traffic participation	Bicycle ↑		BASt	GIDAS					
	Car, Van, <3.5t ↑					INRETS			ELASIS
	truck >3.5t ↑	Czech							
accident (impact and manoeuvre)	frontal↑		BASt						
	Other impact types ↑	Czech							ELASIS
	GOING AROUND BEND ↑				OTS				
	going straight ↑			GIDAS			LAB	DIANA	
	hitting object (immobile) ↑	Czech							
	running off the road ↑		BASt				LAB		
place	Rural ↑	Czech	BASt	GIDAS			LAB		
	Autobahn, National road MOTORWAY OR TRUNK ROAD ↑				OTS			DIANA	
	Country road ↑	Czech	BASt	GIDAS					
	Other roads ↑								ELASIS
	50-100↑		BASt						
	>100 km/h ↑			GIDAS	OTS				
time	**dark ↑**	Czech	BASt	GIDAS	OTS	INRETS	LAB		ELASIS
	0-7:59 ↑	Czech	BASt	GIDAS	OTS		LAB	DIANA	ELASIS
	16-23:59 ↑		BASt	GIDAS	OTS		LAB		ELASIS

bold: found also in WP3 Partners analysis, *italics*: indirectly confirming WP3 Partners analysis

Table 4-9: results from the data request 3B replies calculations - parameter values showing associations with vigilance related accidents (not multivariate)

Regarding cross tabs results from the analysis performed by CIDAUT (DIANA database, Spain), vigilance as a contributing factor is associated to intersection (no intersection) which has not been analysed in the WP8 request.

The time of accident (between 22:00 - 8:00) is also found to be comparably overrepresented in the German, UK, Italian, French, Czech and UK data. The light condition of dawn is only increased in the Spanish data, but darkness is seen for all other countries to be associated to vigilance related accidents.

The road type highway like in the DIANA analysis is found in the OTS data only, but country roads are seen to be overrepresented in the German and Czech data, whereas ELASIS finds other types of roads more typical for vigilance related accidents. The speed limit zones between 100 and 120 km/h is comparably overrepresented also in the UK and German in-depth data showing a 50% to 100%

increased chance that in high speed limit zones a vigilance related accident occurred. A significant overrepresentation of a rural site is only found by the Czech, German, and Italian data.

The results from the CIDAUT analysis for WP3 uses higher level statistic methods for screening on significant associations although remaining on a bivariate level. Therefore their results are compared with the general WP8 requests results. Only the OTS data seem to be comparable in their findings with Spain. The other countries seem to have vigilance related accidents in other sites.

The "WP5-method" as applied by INRETS (EDA database, France) reveals that for vigilance related accidents some typical scenarios can be established. Vigilance related accidents are occurring due to drowsiness, faintness, states of reduced vigilance and alcohol intake, psychotropic drugs and narcotics. Usually these accidents occur because of the human functional failure encountered is classified as an "overall failure". For this failure twelve prototypical scenarios could be elaborated of which 5 relate to the alteration in abilities (29.2%), 6 scenarios that relate to the loss of psycho-physiological abilities (28.5%), and one scenario related to the failure of overwhelmed processing abilities (5.3%). In addition some vigilance related accidents occur due to failures in diagnosis (underestimating a passing road difficulty with 5.5%), decision (deliberately disobeying a safety rule with 7.6%) or execution of a task (poor control of an external disturbance with 4.7%) that are represented in another 4 prototypical scenarios.

In the frame of the TRACE project, the interest into differentiating between the different forms under which vigilance problems lead to accident occurrence relies in finding the means more or less appropriate to counteracting such or such human failure producing scenario. Solutions can't be the same to resolve, for example, a drowsiness occurring on a monotonous straight road and an impaired level of vigilance resulting in a poor evaluation of the speed for negotiating a bend, etc.

The influence of alcohol on the level of vigilance can clearly be derived by this analysis. The accidents where alcohol contributed will on the other way round, be often explained by low vigilance states either (and not by risk taking due to losing one's inhibitions because of alcohol).

By the WP8 data request and comparison it might be possible to transfer the findings from INRETS also to Italy.

4.3 Summary for Trip-related factor "experience"

4.3.1 Results of WP3 Partners analysis of the contributing factor experience

CIDAUT, in-depth data (database "DIANA"), Spain

The calculated model for "Experience" includes the variable age, however, none of the categories selected were significant. No environmental or vehicle characteristics or other variables for accident circumstances were possible to find for characterising experience related accidents more precisely. It has to be assumed, that no typical pattern for these kinds of accidents exists, but can happen at any site, and place under any condition.

In accordance with crosstabs results, the variables more associated with experience are age, driver type and employment. Coherence between variables in crosstabs results can be seen related to the categories more associated with experience: 18-25 years old, private driver and student.

The following table 4-10 shows an overview of the findings of the in-depth analysis of the WP3 Partners on the factor experience. The suggested "potential solution" is given as a plausible consequence from the findings, but cannot provide any effectiveness estimation.

Factor	Partner	Method	Main question	Result	Potential Solution
experience	CIDAUT	Crosstabs	Characteristics associated with "experience" - related accidents.	o 18 – 25 year old drivers o private driver o students	(Graduate Driver's License (GDL) and improvement or increase in driving lessons)

Table 4-10: HUMAN Trip-related factor: experience

4.3.2 *Results of the analysis of the data provided by the WP8 Partners of the contributing factor experience*

Data had been provided by INRETS (France, in-depth), Czech National (Czech Republic, national), OTS (UK, in-depth), DIANA (Spain, in-depth), and LAB (France, in-depth).

As explained in Annex 1 the cross tabulations of experience related accidents and not experience related accidents with explanatory variables from the fields "person characteristics", "traffic participation", "accident characteristics", "site", and "time" were screened for relevant associations by comparing the relative representation of the explanatory variables in the two accident groups (with/without experience as contributing factor) first.

On this basis the calculation of Odds Ratios (OR) with 95% Confidence Intervals was performed to find significant correlations between explanatory variables and the contributing factor experience.

The detailed results are pictured in Annex II.

From the person characteristics it can only be stated that female gender is more often found in experience related accidents, but only the Czech data can provide a significant result for the under-representation of male gender with an OR of 0.85 (95% Confidence Interval [0.56;0.90]. The age group of 25 to 44 years old is only under-represented in experience related accidents for the Czech national data (OR 0.9) which show a tendency for the age group of older than 65 years old. The LAB, OTS and DIANA data show a higher share of drivers under the age of 25 (OR 3.1 to 13) and a non significant tendency for the same age group in the INRETS data. Only 3 databases provide information on the occupation, and the only significant results are found in the DIANA and LAB database for an under-representation of workers/employees (OR 0.3) being involved in experience related accidents. A tendency for students to be over-represented can be seen in both French databases.

From the traffic participation data it is found that in the Czech data especially bicycle riders are more often involved in accidents where experience was contributing compared to other accidents (OR 4.1). Powered-Two-Wheelers were found to be overrepresented in experience related accidents as found in the OTS data (OR 4.3).

From the accident characteristics the Czech data find an overrepresentation of accidents other than frontal, side or rear impacts (OR 5.5) and the LAB data show the same tendency without reaching significance. A tendency for rear end impacts is seen for the OTS and INRETS data. In single vehicle accidents typically for experience related accidents compared to accidents where experience was not contributing "running off the road" is found in the Czech data (OR 5.1). A tendency for rollovers is seen for the OTS, DIANA and LAB data The manoeuvre more often seen in accidents where experience was contributing is "going around bend" as specific part separated from "going straight" in the OTS data (OR 1.8) and "turning" in the LAB data (OR 2.1).

The place for experience related accidents compared to other accidents is found to be rural except for the OTS data (significant difference for Czech data, OR 1.5). The road type is more often a country roads in the INRETS data (OR 6.2) and other roads in the Czech Republic (OR 1.3). In German and UK in-depth databases show that experience related accidents are typically occurring in speed limit zones of higher limits than 100km/h (70MPH) (OR 1.5 and 2.1). A tendency for the same direction of overrepresentation, but not reaching significance is also seen in the INRETS and DIANA data.

The analysis of light conditions show that experience related accidents are significantly over-represented in dark light conditions only in the Czech data (OR 1.4) and a tendency for daylight is seen for INRETS and DIANA data, and dusk/dawn light conditions for the LAB data. The time between midnight and 8:00 o'clock) and the time between 16:00 and midnight is overrepresented in the Czech data (OR 1.3 and 1.4) A tendency in the same directions is only seen for DIANA, the OTS and LAB data show a tendency for the time between 8 and 16:00 o'clock.

4.3.3 Summary, Discussion and Conclusion of the analysis of the contributing factor experience

Experience refers to all states concerning the humans low experience in driving a vehicle that contributed to an accident occurrence, e.g.: novice driver, foreign driver, driving seldom, driving in traffic someone is not used to (city traffic while used to rural sites), not enough knowledge of the traffic rules and informal laws, or, the driver indicates that he/she "does not have enough experience"

By Literature no definite Risk estimates of "experience" were found for increasing the chance for being involved in an accident, due to experience often not being separable from age, and, approximations like annual (or weekly or monthly) driving distance or driving time, is a combination of expressing experience, but on the other hand increase of exposure time and distance.

From task 3.1 it was concluded that experience contributed to accidents in up to 12% of the accidents contained in the databases available to the TRACE Partners.

From the data request 3A further it can be seen that experience is overrepresented as contributing to accidents in three databases available to the TRACE partners by factors between 1.3 and 2.6. In fatal accidents experience is overrepresented in four databases with factors between 1.2 and 4.3.

In task 3.3 it was found that typical pattern for experience related accidents can not be defined. But various explanatory variables are overrepresented in accidents where experience was contributing in comparison to other accidents.

The factor experience was analysed by CIDAUT using the statistical method. The logistic regression modelling didn't lead to a significant result. In accordance with crosstabs results, the variables more associated with experience are age, driver type and employment: 18-25 years old, private driver and student.

As summary from this in-depth statistical analysis the following table 4-11 presents the bivariate associations found.

It has to be reminded that although a multitude of in-depth data had been screened for associations, only those presented reached significance for characterizing experience-related accidents.

parameter values representation for experience	CIDAUT (Spain in-depth)
Significant bivariate associations	18 – 25 year old drivers↑ private driver↑ students ↑

Table 4-11: results of the statistic analysis by the Partners in task 3.3 for factor experience

Younger age is also found by the bivariate analysis based on the data request 3B for the databases of OTS and LAB, as well as an under-representation of the age group of the 25 to 44 year olds is found in the Czech data. Driver type (professional/private) was not requested, but occupation "student" could only partly be confirmed, however, an under-representation of the majority of traffic participants with the occupation "worker/employee" is seen.

As summary from statistic analysis of the WP8 replies the following table 4-12 presents the Databases following the 3B request that show significant bivariate associations for explanatory variables with experience related accidents.

explanatory variables	parameter values representation for experience	Czech national	OTS (GB in-depth)	INRETS (France in-depth)	LAB (France in-depth)	DIANA (Spain in-depth)
person	Male ↓	Czech				
	<25 ↑		OTS		LAB	DIANA
	25-44 ↓	Czech				
	worker/employee ↓				LAB	DIANA
traffic participation	PTW ↑		OTS			
	Bicycle ↑	Czech				
accident (impact and manoeuvre)	Other impact types ↑	Czech				
	running off the road ↑	Czech				
	GOING AROUND BEND ↑		OTS			
	turning ↑				LAB	
place	Rural ↑	Czech				
	Country road ↑			INRETS		
	Other roads ↑	Czech				
time	Dark ↑	Czech				
	8-15:59 ↓	Czech				

bold: found also in WP3 Partners analysis, *italics*: indirectly confirming WP3 Partners analysis

Table 4-12: results from the data request 3B replies calculations - parameter values showing associations with experience related accidents (not multivariate)

In general it has to be concluded that experience related accidents occur more often to younger / novice drivers and students, but also like shown in the Czech data, older drivers might have problems when experience is related to the site, new road layouts or regulations. Typically females of the age over 60 driving seldom or reporting to have difficulties in driving in unfamiliar areas seem to have higher crash risks as found in the literature review (Oxley, 2005). From the WP8 request also a tendency for female drivers is seen. A logistic regression model performed with the Czech national data would possibly be able to give additional information here. Due to selection criteria and coding definitions this was not possible to confirm by the in-depth CIDAUT analysis. In general further it is possible to conclude that highways don't seem to be a major issue in experience related accidents. For the time of day and light conditions very inhomogeneous results are found.

4.4 Summary for Trip-related factor "vehicle condition"

4.4.1 Results of WP3 Partners analysis of the contributing factor vehicle condition

BASt – in-depth German data (GIDAS), passenger cars only, Factor vehicle condition

Vehicle condition / vehicle maintenance was chosen as trip related factor from the vehicle component. One interesting result which came out of the analysis is that vehicle maintenance faults only seem to result in an accident during trips at motorways at very high velocity (greater than 100km/h). At lower speed the driver might be able to compensate the effect of the technical defect.

Another mentionable observation based on the results of the analysis of vehicle condition related accidents was the fact that vehicle related parameters did not show a significant correlation. One might have expected variables like vehicle type or age to turn out relevant in the analysis. However, almost all relevant variables were related to environment (infrastructure) and type of accident.

Also one variable from the human component was found to be relevant. In the bivariate analysis unemployed was shown to be overrepresented in the group of accidents where vehicle condition was contributory. Possible explanations could be that unemployed persons do not have sufficient money for appropriate maintenance of their vehicles or unemployed person might be less thoroughly caring about the maintenance status of their cars. However, this result does not show to be significant in the logistic regression analysis.

Other variables regarding circumstances of the accident, which showed to be relevant in vehicle condition related accident based on bivariate and logistic regression analysis are number of occupants and number of involved vehicles. The number of involved vehicles is one in most vehicle conditions related accidents, which shows that no other vehicle was involved. The number of occupants seems to be higher than one in accidents where vehicle condition was a contributing factor. One possible explanation could be the higher weight when carrying passengers which might be of influence in passenger car accidents. But, a definite explanation for this was not found yet.

CIDAUT, in-depth data (database "DIANA"), Spain

In DIANA database, Vehicle condition is considered as a contributing factor whenever the vehicle condition does not observe the legal prescription for an accurate operation. It is related to tyres conditions in the majority of DIANA cases.

The model provided for vehicle condition does not include any significant variable. In crosstabs analyses, there were two variables more associated with vehicle condition as a contributing factor, which were engine power (the category "200-400 cv.") and day of week (the category "Thursday").

Vehicle power is usually in accordance with vehicle size. In DIANA database, vehicles with an engine power higher than 200 cv. are the ones (bus and trucks) with a weight higher than 3.500 kg. In the same way, drivers involved in an accident where vehicle condition is contributory had tyres in bad conditions, which are usually influenced by the vehicle weight.

The association found between vehicle condition and the day of the week may be related to the frequency of trips in a week and its influence in vehicle condition. However, more research in this line is recommended in order to propose adjusted measures. For example, investigating possible associations between number of kilometres per week and accidents where vehicle condition is contributory, or even number of days from last review, could show a guideline to state periodical reviews for different drivers or vehicle types.

Anyhow, the development of Advanced Driver Assistance Systems (ADAS) constitutes nowadays an important field of research, including vehicle condition detective and warning systems (e.g. Tyre Pressure Monitoring and Warning). This could be a good future line of measures, according to the model observed in DIANA data.

A combination of in-vehicle and regulation, guidelines or educational measures should be recommended due to limitations on systems found by Van Elslande et al. (2008). So, for example, authors showed that the motive for the journey and the underestimation of danger could limit the effectiveness of Tyre Pressure Monitoring and Warning system. Therefore, as it has been stated above, research to improve the safety effectiveness of these functions should be promoted, considering the set of suggestions proposed by the authors (Van Elslande et al. 2008).

The following table 4-13 shows an overview of the findings of the in-depth analysis of the WP3 Partners on the factor vehicle condition. The suggested "potential solution" is given as a plausible consequence from the findings, but cannot provide any effectiveness estimation.

Factor	Partner	Method	Main question	Result	Potential Solution	Comment
Vehicle Condition	BASt	Logistic Regression	Circumstances of accidents where factor vehicle condition was contributing	• Motorway↑↑ • More than one occupant in vehicle↑ • Urban roads ↓↓	Condition of vehicles which are frequently operated at high velocities should be checked frequently.	Relevance of accidents related to vehicle maintenance is low in Germany. However, other countries might benefit from proposed solution
Vehicle Condition	CIDAUT	Cross tabulation	Environmental characteristics associated with "vehicle condition" - related accidents.	o Day of week o vehicle power	- Development of in-vehicle systems: ADAS to warn the vehicle state (e.g. Tyre Pressure Monitoring and Warning). - Research to promote or estimate periodical reviews associated with periodical trips and vehicle type.	

Table 4-13: VEHICLE Trip-related factor: vehicle condition

4.4.2 Results of the analysis of the data provided by the WP8 Partners of the contributing factor vehicle condition

Data had been provided by INRETS (France, in-depth), Czech National (Czech Republic, national), OTS (UK, in-depth), GIDAS (Germany, in-depth), BASt (Germany, national), DIANA (Spain, in-depth), and LAB (France, in-depth).

As explained in Annex 1 the cross tabulations of vehicle condition related accidents and not vehicle condition related accidents with explanatory variables from the fields "person characteristics", "traffic participation", "accident characteristics", "site", and "time" were screened for relevant associations by comparing the relative representation of the explanatory variables in the two accident groups (with/without vehicle condition as contributing factor) first.

On this basis the calculation of Odds Ratios (OR) with 95% Confidence Intervals was performed to find significant correlations between explanatory variables and the contributing factor vehicle condition.

The detailed results are pictured in Annex II.

From the person characteristics it can only be stated that male gender is more often found in vehicle condition related accidents, but only the German national data can provide a significant result for the overrepresentation of male gender with an OR of 1.7 (95% Confidence Interval [1.60;3.23]. The other databases except for INRETS show the same tendency. The age group of younger than 25 years old is only over-represented in vehicle condition related accidents for the German data (OR 1.6) and the same tendency is found in the OTS, DIANA and INRETS data. In contrast the Czech national and

INRETS data show a tendency for the age group of 45 to 65 years old. Only 4 databases provide information on the occupation, and the only significant results are found in the GIDAS database for an overrepresentation of unemployed (OR 2.6) being involved in vehicle condition related accidents. A tendency for workers/employees to be over-represented can be seen in both French and the DIANA databases.

From the traffic participation data it is found that in the Czech and OTS data especially trucks are more often involved in accidents where vehicle condition was contributing compared to other accidents (OR 14.2 and 3.3) and the same tendency of truck overrepresentation is seen for all other databases. Bicycles were found to be overrepresented in vehicle condition related accidents as found in the German data (OR 3.6) and a tendency in the same direction in the OTS data.

From the accident characteristics the Czech and GIDAS data find an overrepresentation of accidents other than frontal, side or rear impacts (OR 3.4 and 3.2). A tendency for frontal impacts is seen for the DIANA, LAB and BASt data (OR 1.7 in BASt data) and INRETS and OTS show a tendency for side impacts. In single vehicle accidents typically for vehicle condition related accidents compared to accidents where vehicle condition was not contributing "running off the road" is found in the Czech and GIDAS data (OR 5.0 and 2.4). A manoeuvre more often seen in accidents where vehicle condition was contributing is not found, but in the DIANA and INRETS data a tendency for overtaking.

The place for vehicle condition related accidents compared to other accidents is found to be rural except for the DIANA and LAB data (significant difference for German data, OR 2). The road type is more often the autobahn/motorway/national road in the German, OTS and DIANA data (OR 1.7 to 3.1), a country road in the Czech data (OR 3.6) and INRETS data show a tendency for other types of roads. The BASt and OTS data show that vehicle condition related accidents are typically occurring in speed limit zones of higher limits than 100km/h (70MPH) (OR 1.6 and 3.1). A tendency for the same direction of overrepresentation, but not reaching significance is also seen in the LAB and GIDAS data.

The analysis of light conditions show a tendency that vehicle condition related accidents are over-represented in dusk/dawn light conditions for the LAB, Czech and GIDAS data. An overrepresentation of darkness is seen for BASt and OTS; INRETS and DIANA find a tendency for daylight conditions. The time between 8 and 16:00 o'clock is overrepresented in the Czech, DIANA, OTS, GIDAS and INRETS data, whereas GIDAS and LAB show an under-representation for this time of day.

4.4.3 Summary, Discussion and Conclusion of the analysis of the contributing factor vehicle condition

Vehicle condition /maintenance refers to all states (not actual and dynamic conditions) concerning the vehicle that contributed to an accident occurrence, e.g.: low tyre pressure or profile, any existing defects of brakes, steering, suspension, cracks in windscreen, no wiping water, etc., that are not suddenly occurring (like an acute tyre blow-out) but are known when starting the trip.

By Literature no definite Risk estimates of "vehicle condition" were found for increasing the chance for being involved in an accident. In general the risk estimates for traffic accidents applied to some of these factors (especially tyres and brakes) seem to be high, especially for trucks

From task 3.1 it was concluded that vehicle condition contributed to accidents in up to 2% of the accidents contained in the databases available to the TRACE Partners, and 11% for truck accidents.

In the databases Tyres as contributing to accidents on a trip level are found in up to 1.6% for most of the databases, only two databases present higher frequencies of 7% and 11.5%, respectively. Brakes (up to 1% of accidents), steering system (up to 0.1% of accidents), window defects (up to 0.3% of accidents), defective lights or driving without lights (up to 1% of accidents), don't seem to play a major role in contributing to accidents.

From the data request 3A further it can be seen that vehicle condition (tyres) is overrepresented as contributing to accidents in one databases available to the TRACE partners by 3.1 times In fatal accidents vehicle condition (especially tyres) is overrepresented in five databases with factors between 1.3 and 10.8.

In task 3.3 it was found that typical pattern for vehicle condition related accidents can be defined for passenger cars (BASt), but not in general (as shown by CIDAUT).

As summary from the WP3 Partners' in-depth statistical analysis the following table 4-14 presents the pattern and bivariate associations found.

It has to be reminded that although a multitude of in-depth data had been screened for associations, only those presented reached significance for characterizing vehicle condition -related accidents.

parameter values representation for vehicle condition	GIDAS (Germany in-depth) Passenger cars only	CIDAUT (Spain in-depth)
Pattern: variables included in the logistic regression model (GIDAS) and Significant bivariate associations (CIDAUT)	crossing or turning ↓ leaving road ↑ Other character of accident* ↑ Road network straight ↑ Road network traffic node↓ Number of involved vehicles >1↓ Number of occupants >1 ↑ unemployed ↓ federal motorways ↑ urban roads ↓	engine power 200-400 cv. day of week Thursday

** other than Collision with another vehicle starting or stopping, Collision with another vehicle moving ahead or waiting, Collision with another vehicle moving lateral, same direction, Collision with another oncoming vehicle, Collision with another vehicle turning or crossing, Collision between vehicle pedestrian, Collision with obstacle on the road, Leaving road (left-hand-side), Leaving road (right-hand-side)*

Table 4-14: results of the statistic analysis by the Partners in task 3.3 for factor vehicle condition

From data request 3B it is also found that circumstances associated to vehicle condition related accidents in comparison to accidents to which vehicle condition was not contributing exist.

As summary from statistic analysis of the WP8 replies the following table 4-15 presents the Databases following the 3B request that show significant bivariate associations for explanatory variables with vehicle condition related accidents. INRETS and DIANA data were not possible to find significant results and are therefore not included in this table.

explanatory variables	parameter values representation for vehicle condition	Czech national	BASt (Germany national)	GIDAS (Germany in-depth)	OTS (GB in-depth)	LAB (France in-depth)
person	Male ↑		BASt			
	<25 ↑		BASt	GIDAS		
	Unemployed ↑			GIDAS		
traffic participation	**truck >3.5t ↑**				OTS	
	Bicycle ↑		BASt	GIDAS		
accident (impact and manoeuvre)	Frontal ↑		BASt			
	Other impact types ↑			GIDAS		
	Other crash types (single vehicle crashes) ↑		BASt			
	running off the road ↑			GIDAS		
	other manoeuvre ↑				OTS	
place	**Rural ↑**		BASt	GIDAS		
	Autobahn, National road MOTORWAY OR TRUNK ROAD ↑		BASt	GIDAS	OTS	
	Country road ↑	Czech				
	>100 km/h ↑		BASt		OTS	
time	Dark ↑		BASt			
	Dark ↓	Czech				
	Day ↓					LAB
	16-23:59 ↑		BASt			
	8-15:59 ↓↓	Czech				

bold: found also in WP3 Partners analysis, *italics*: indirectly confirming WP3 Partners analysis

Table 4-15: results from the data request 3B replies calculations - parameter values showing associations with vehicle condition related accidents (not multivariate)

The BASt analysis for WP3 was restricted to passenger cars as recommended for focussing on prevention measures that might include vehicle active safety systems. The WP8 request includes all types of traffic participation. There the finding of the CIDAUT analysis for WP3 is confirmed that vehicle condition is mainly a contributing factor for trucks. In addition bicycles seem to be affected by vehicle condition as a contributing factor for accidents.

The model calculated by the BASt analysis of the GIDAS data on passenger cars for WP3 showed that from person characteristics only the occupation might be of relevance (although no significant contribution in logistic regression model), and for unemployment the chance is contradictory compared to the model, as found by the bivariate analysis on all traffic participants. Age and gender don't show any relevance for the logistics regression model. Male and the age group of younger than 25 years old can only be found in the general analysis of the German data to be associated to vehicle condition related accidents, but cannot definitely be confirmed by other databases. It has to be concluded that accidents where the vehicle condition contributed are not associated to typical person characteristics.

The street type "motorways" was significantly overrepresented in passenger cars accidents related to vehicle condition. The data request 3B also shows motorways to be over represented (BASt, GIDAS, OTS). Only the Czech data show an elevated over representation for country roads. Both can be explained by the fact that only at high velocities a vehicle defect resulting from maintenance problems leads to a severe accident. At low velocities the driver can keep control of his vehicle.

This is confirmed by the finding that urban roads are significantly underrepresented in the group of vehicle condition related accidents. This is also found nearly all databases from the WP8 request, although not reaching significance level. Leaving the road and unspecified kinds of accidents are also only found by the German data analysis from WP8. No typical manoeuvres were obtainable.

The time of week did show an association by the CIDAUT analysis for WP3 which was not requested from WP8.

From the WP8 request it is not possible to conclude if the pattern found by the WP3 analysis is applicable or at least comparable to the other European countries, it might be at maximum possible for the BASt pattern to transfer to the UK. Unfortunately most often it is a lack of data so that no reliable results could be obtained. Further, the analyses comprise too different target groups.

Thus only the pattern by the WP3 analysis by BASt for passenger cars can give an idea where and how vehicle condition related accidents occur; further, from the CIDAUT analysis that regular checks might be beneficial, and last, from the WP8 request, that in addition to trucks also bicycles should be checked more frequently.

4.5 Summary for Trip-related factor "road condition" and "road layout"

4.5.1 Results of WP3 Partners analysis of the contributing factors "road condition" and "road layout"

BASt – in-depth German data (GIDAS), passenger cars only, Factor "road condition"

The investigation of the factor from the environmental component (road condition) only provided relevant variables on environment and circumstance. Vehicle and human related variables do not show a high correlation with accidents were road condition was an accident factor.

The most relevant variables are related to the location of the accident. Road condition related accidents seem to happen with significantly high frequency in rural areas on federal and district highway. This correlates with the original velocity of the vehicle which is overrepresented in the range of 60 to 100 km/h for road condition related accidents.

The type of accident seems to be a driving accident in a significantly high number of cases compared to accident were the factor was not present. Also the results on the variable month of accident, confirms what would have been expected. Winter is the season which is significantly high overrepresented for accidents were road condition was a contributing factor.

VSRC – in-depth UK data, Factor road layout

A statistical overview was undertaken of cases involving cars in the OTS database where road layout was a contributory factor and comparison made with car cases where road layout was not recorded as a contributing factor. Any positive results (i.e. an explanatory variable occurred proportionally more often in 'road layout factor' cases than 'road layout not causation factor' cases) would imply that when a 'difficult' road layout (bend, steep hill, narrow road) was contributing to an accident, other road/environment/user characteristics are more likely to be present. However, this could only be implied, as only a general statistical overview was undertaken and no analysis of the interaction between different types of explanatory variables was carried out. However, from the analysis that was undertaken, the following accident characteristics (explanatory variables) were found to be significantly more related to accidents where road layout was a causation factor:

For cases where road layout was a contributory factor, the statistical overview revealed that road layout was more likely to be causative on high-speed, minor, rural single carriageway roads with low density traffic at night, not at an intersection, involving a single car with a young driver who was not undertaking a manoeuvre, but going ahead on a bend with a degraded road surface (defects or contaminants).

It could be said that a combination of these explanatory variables may increase the likelihood of an accident occurring when a road user negotiating a bend/slope/narrow road, which gives a good indication of where the greatest risk may lie. These accidents may involve a lack of driving of experience of the young road user on the conditions stated, and also it would be expected that levels of risk taking in these type of accidents would be high, as it is suspected that lack of driving experience plus an intentional level of risk taking coupled with less than desirable road conditions will greatly increase the likelihood of a human functional failure leading to accident.

The results of the case analysis by the WP5 method on a selection of the road layout related accidents in this material show additional information. The following tables give an overview on the scenarios and further contributing factors found by the WP5 method for the primary (table 4-16) and non primary road users (table 4-17).

<table>
<tr><th></th><th>Prototypical scenarios and Human functional failures for primary active road users in accidents where road layout was contributing</th><th colspan="2">Most frequent Factors contributing to the failure occurrence (HUMAN and ENVRIONMENTAL)</th></tr>
<tr><td>T1B</td><td>Under evaluation of the difficulty of a known bend</td><td rowspan="3">User behaviour - Risk taking (speed)
User inexperience - Driving
User state - In a hurry</td><td rowspan="3">Road geometry – Bends
Road surface condition
Visibility impaired - Terrain profile</td></tr>
<tr><td>D2Y</td><td>Intentional risk taking (e.g. illegal or inappropriate speeding) when negotiating a left or right bend</td></tr>
<tr><td>P1X</td><td>Road user surprised by non-visible vehicle approaching from the side at a non-priority intersection</td></tr>
</table>

Table 4-16: failure generating scenarios for road layout related accidents – primary active involved party

<table>
<tr><th></th><th>Prototypical scenarios and Human functional failures for primary active road users in accidents where road layout was contributing</th><th colspan="2">Factors contributing to the failure occurrence (HUMAN and ENVRIONMENTAL)</th></tr>
<tr><td>T5A</td><td>Expecting a non-priority vehicle not to undertake a manoeuvre in intersection</td><td rowspan="3">User state - Right of way status</td><td rowspan="3">Traffic condition - Other road user
Visibility impaired - Terrain profile</td></tr>
<tr><td>T5X</td><td>Expecting another road user in the opposing/lateral lane not to perform an erroneous manoeuvre on a right or left bend</td></tr>
<tr><td>T6X</td><td>Expecting another road user in the opposing carriageway to perform an avoidance manoeuvre when negotiating a bend or incline</td></tr>
</table>

Table 4-17: failure generating scenarios for road layout related accidents – not primary active involved party

Primary active road users

For primary active road users, there were 2 most frequent typical failure generating scenarios in the sample. The first involved a failure to judge the bend ahead (i.e. tighter than expected), and combined with the road users' risk taking actions and other factors (e.g. alcohol, fatigue, little driving experience and poor road surface), led to the road user losing control. Or, after evaluating correctly the bend ahead, the second scenario involved a failure in deciding how to negotiate the bend correctly (i.e. intentional risk taking), which coupled with other factors, led to a loss of control. There was found to be a close link with risk taking, lack of driving experience and also visibility issues (related to road geometry issues) when negotiating bends.

Therefore driver assistance systems which give advance information of the road geometry ahead may assist less experienced drivers, and those that have no experience of the route, by informing them of the best speed to negotiate the bend at. Also, it is important to ensure that new and learner drivers are educated regarding the dangers of driving too fast on bends, steep roads and narrow roads, so they have the knowledge and skill to negotiate these road situations safely. However, there will also be those drivers to which no amount of education and information will deter them from intentionally risk taking and for these drivers, enforcement methods, such as speed limiters and as a last resort, police enforcement may be the only deterrent.

Non-primary active road users

For the non primary active road users in 'road layout as a factor' accidents, it was their failure to expect that another road user in their view would undertake an erroneous manoeuvre that mainly led to the accident occurring (i.e. it was too late avoid by the time the rupture phase occurred).

The types of safety devices which would help road users avoid errant vehicles who have lost control on a bend/hill/narrow road would involve advance warning mechanisms which informs them of a potential conflict which could be in plain view or out of their field of vision or control systems, such as ESC and ABS.

The following table 4-18 shows an overview of the findings of the in-depth analysis of the WP3 Partners on the factor road condition and layout. The suggested "potential solution" is given as a plausible consequence from the findings, but cannot provide any effectiveness estimation.

Factor	Partner	Method	Main question	Result	Potential Solution	Comment
Road Condition	BASt	Logistic Regression	Circumstances of accidents where factor road condition was contributing	• Driving accidents↑↑ • Traffic regulated by traffic control↑ • Crossing or turning accidents↓↓ • Urban location↓↓	Improvement of road maintenance in rural areas. Warning signs and driver education to avoid road condition related driving accidents.	Bivariate analysis indicated an overrepresentation of accidents with no traffic regulation, which is contradictory to finding from logistic regression
Road layout (geometry)	VSRC	General statistical overview	Which explanatory variables are more often associated with road layout (geometry)?	Human • Drivers <25 years Participation • Single car accidents • Car drivers Accident • Frontal impacts • No manoeuvre Environment • Night (darkness) • Rural roads • Minor roads • Single carriageway • Non-intersection • 60mph (97kph) speed limit • Bends • Poor road surface • Light density traffic	Advance warning signage which can be seen at night . Reduced speed limits on approach to and at bends/steep hills/narrow roads on minor rural, less well used roads.	
Road layout (geometry)	VSRC	In-depth analysis of sample of cases using WP5 methodology	What are the most typical failure generating scenarios in accidents where road layout was a cause?	**Primary active** - D2Y, T1B. Road layout contributes mainly to decision-making or diagnosis failures. Link made with risk taking, low driving experience and poor visibility due to bend. **Non-primary active** – T5X. Mainly prognosis failures (expectation)	Systems which evaluate the terrain/ surface condition to give an advisory speed. Advance warning devices to warn drivers of errant vehicles, either in plain view or out of view. Education for new drivers on driving on bends. Stringent police enforcement for intentional risk takers.	

Table 4-18: ENVIRONMENT Trip-related factors: road condition and road layout

4.5.2 Results of the analysis of the data provided by the WP8 Partners of the contributing factor road condition and road layout

Data had been provided by INRETS (France, in-depth), Czech National (Czech Republic, national), OTS (UK, in-depth), GIDAS (Germany, in-depth), BASt (Germany, national), DIANA (Spain, in-depth), LAB (France, in-depth); ELASIS (Italy, in-depth).

As explained in Annex 1 the cross tabulations of road condition and layout related accidents and not road condition and layout related accidents with explanatory variables from the fields "person characteristics", "traffic participation", "accident characteristics", "site", and "time" were screened for relevant associations by comparing the relative representation of the explanatory variables in the two accident groups (with/without road condition and layout as contributing factor) first.

On this basis the calculation of Odds Ratios (OR) with 95% Confidence Intervals was performed to find significant correlations between explanatory variables and the contributing factor road condition and layout.

The detailed results are pictured in Annex II.

From the person characteristics it can be stated that female gender is found in road condition and layout related accidents for the Czech and Italian data (OR for males 0.9 both), and the same tendency by the INRETS and GIDAS data. The age group of younger than 25 years old is overrepresented in road condition and layout related accidents for ELASIS (OR 1.2) and INRETS (not significant). BASt finds an overrepresentation of 45 to 64 years old (OR 1.2) , and GIDAS and DIANA show a tendency for the age group of 25 to 45 years old. No specific age group is dominating road condition and layout related accidents in other databases. Only 4 databases provide information on the occupation, and the only significant result is found in the INRETS database for an overrepresentation of students being involved in road condition and layout related accidents (OR 4.8).

From the traffic participation data it is found that in the German national and OTS data especially Powered-Two-Wheelers are more often involved in accidents where road condition and layout was contributing compared to other accidents (OR 4.0 and 1.8). Also bicycle riders were found to be overrepresented in road condition and layout related accidents as found in the ELASIS data (OR 1.5).

From the accident characteristics in the BASt and in the ELASIS data an overrepresentation of frontal impacts is found for road condition and layout related accidents (OR 2.9 and 1.9). The Czech data find an overrepresentation of accidents other than frontal, side or rear impacts (OR 1.7). A tendency for rear end impacts is seen in the DIANA data and for side impacts in the INRETS data, but no significant association is found. In single vehicle accidents for road condition and layout related accidents compared to accidents where road condition and layout was not contributing "running off the road" is found in the Czech and GIDAS data (OR 2.0 and 4.3). The OTS finds rollover accidents to be typical for road condition and layout related accidents compared to not road condition and layout related accidents (OR 1.7). Hitting immobile objects is found by ELASIS (OR 1.4) and other types are found by the BASt data (OR 3.1). The manoeuvre more often seen in accidents where road condition and layout was contributing is "going around bend" by the OTS (OR 8.8) and "crossing" is significantly under-represented in the ELASIS data (OR 0.9). Only DIANA finds a tendency for turning to be more typical for road condition and layout related accidents than other accidents.

The place for road condition and layout related accidents compared to other accidents is found to be rural in all databases (significant results for Czech, OTS, BASt, ELASIS, OR 1.5 to 2.3). The road type is also found to show significant associations with an overrepresentation of country roads by Czech OTS, BASt and ELASIS data (OR 1.2 to 3.5). The database of BASt shows an over-representation of zones with a speed limit of lower than 50km/h. OTS and LAB show a tendency for zones with a speed limit between 50 and 100km/h. A tendency for an overrepresentation in high speed limit zones, but not reaching significance is also seen in the INRETS and DIANA data.

The time of the day and the light conditions show that road condition and layout related accidents are over-represented in dark light conditions (OR 1.1 to 3.2) for Czech, BASt and ELASIS data. In the time between 16:00 and midnight BASt and ELASIS can show an overrepresentation (OR 1.3 and 1.1), a tendency in the same direction is seen for GIDAS and DIANA data. In addition the BASt and Czech data can show an overrepresentation of the time between midnight and 8 o'clock (OR 1.1 and 1.3).

4.5.3 *Summary, Discussion and Conclusion of the analysis of the contributing factor road condition and layout*

Road layout refers to all states (not actual and dynamic conditions) concerning the road that contributed to an accident occurrence, e.g.: narrow road, state of surface (potholes), bend, state or absence of signs or signals, defect/dim lighting, grooves in connection with rain, irregular condition of traffic signs, insufficient lighting, insufficiently secured railway crossings or other constant road conditions.

By Literature Review it was found that in general the risk for accidents is 6 fold increased in bad road layout/geometry/infrastructure conditions compared to good ones.

From task 3.1 it was concluded that road layout condition contributed to accidents in up to 11.6% of the accidents covered by the databases available to the TRACE Partners.

From the data request 3A further it can be seen that road condition is overrepresented as contributing to accidents in two databases available to the TRACE partners by factors between 1.4 and 2.0. In fatal accidents road layout is overrepresented in five databases with factors between 1.2 and 6.0.

In task 3.3 it was found that typical pattern for road layout related accidents can be defined and that road layout related accidents differ from accidents where road condition and layout didn't contribute in various variables.

The factor road condition was analysed by BASt using the statistical method and by the VSRC road layout was analysed by applying a more general statistical method and the WP5 method.

As summary from the WP3 Partners' in-depth statistical analysis the following table 4-19 presents the pattern and bivariate associations found.

It has to be reminded that although a multitude of in-depth data had been screened for associations, only those presented reached significance for characterizing vehicle condition -related accidents.

parameter values representation for road condition and layout	BASt (GIDAS, Germany in-depth) Passenger cars only Road condition and layout	VSRC (OTS, UK, in-depth) Road layout
Pattern: variables included in the logistic regression model (GIDAS) and Significant bivariate associations (VSRC)	driving accident ↑ crossing or turning ↓ leaving road ↓ Original velocity >60 kph ↑ Traffic control regulated ↑ Location urban ↓ highways or motorways ↓ Season: Winter ↑	<25 years ↑ Single car accidents ↑ Car drivers ↑ Frontal impacts ↑ No manoeuvre ↑ Night (darkness) ↑ Rural roads ↑ Minor roads ↑ Single carriageway ↑ Non-intersection ↑ 60mph (97kph) speed limit ↑ Bends ↑ Poor road surface ↑ Light density traffic ↑

Table 4-19: results of the statistic analysis by the Partners in task 3.3 for factor road condition and layout

From data request 3B it is also found that circumstances associated to road condition and layout related accidents in comparison to accidents to which vehicle condition was not contributing exist.

As summary from statistic analysis of the WP8 replies the following table 4-20 presents the Databases following the 3B request that show significant bivariate associations for explanatory variables with road condition and layout related accidents. There was no significant result for the LAB and DIANA data analyses; therefore they are not included in table 4-20.

explanatory variables	parameter values representation for road condition and layout	Czech national	BASt (Germany national)	GIDAS (Germany in-depth)	OTS (GB in-depth)	INRETS (France in-depth)	ELASIS (Italy in-depth)
person	Male ↓	Czech					ELASIS
	<25↑						ELASIS
	45-64↑		BASt				
	Student ↑					INRETS	
traffic participation	PTW↑		BASt		OTS		
	bicycle↑						ELASIS
accident (impact and manoeuvre)	*frontal*↑		BASt				ELASIS
	Other type of impact ↑	Czech					
	Other type of single vehicle crash↑		BASt				
	rollover↑				OTS		
	running off the road ↑	Czech		GIDAS			
	hitting object (immobile) ↑						ELASIS
	going around bend ↑				OTS		
	crossing↑						ELASIS
place	**Rural**↑	Czech	BASt		OTS		ELASIS
	Country road ↑	Czech			OTS		ELASIS
	Other roads↑		BASt				
	<50 km/h↑		BASt				
time	dark↑	Czech	BASt				ELASIS
	0-7:59 ↑	Czech					
	0-7:59 ↓						ELASIS
	16-23:59↑		BASt				ELASIS

bold: found also in WP3 Partners analysis, *italics*: indirectly confirming WP3 Partners analysis

Table 4-20: results from the data request 3B replies calculations - parameter values showing associations with Road condition and layout related accidents (not multivariate)

The analysis of the factor road condition and layout by BASt (GIDAS database, Germany, only passenger cars accidents) showed that typical accident circumstances were overrepresented in road condition related accidents compared to the accidents where road condition was not involved.

Road condition and layout related accidents don't seem to happen to a certain person group. The data from the WP8 request show an overrepresentation of females for the Czech and Italian data, and no striking results for a certain age group or occupation.

Road condition and layout related accidents occur with significantly high frequency in rural areas but not on federal and district highway. This correlates with the original velocity of the vehicle which is overrepresented in the range of 60 to 100 km/h for road condition related accidents. Comparable results for the type of road and rural sites are found for the Czech, OTS, ELASIS and BASt national data.

The type of accident seems to be a driving accident in a significantly high number of cases compared to accident were the factor was not present. Frontal impacts are seen to be overrepresented in the German national and the Italian in-depth data. But, controversial results are found for crossing and turning and leaving the road accidents. Whereas the logistic regression model based on the GIDAS data shows for those types an under-representation, the Czech, GIDAS and ELASIS bivariate analysis shows over-representations. As PTWs and bicycles are the only over-represented types of traffic participation in the WP8 request analysis (UK, German national, and Italy) and the logistic regression model is based on passenger cars only, the differing results might be explainable.

In the logistic regression model the result on the variable month of accident confirms what would have been expected. Winter is the season which is significantly high overrepresented for accidents were road condition was a contributing factor. This was not requested from WP8 and cannot be compared.

In general the results by the WP8 data analysis cannot be compared easily with the pattern as found by BASt. Only for the under-representation of highways (as also found by the Czech Republic, the UK and Italy) no common variable associations are detectable.

The bivariate analysis of the VSRC analyses only a part of the factor road condition and layout, including only the factor road layout (narrow, steep or winding road). The analysis of the OTS database by VSRC (UK) showed that road layout related accidents happen to occur more often on high-speed, minor, rural single carriageway roads with low density traffic at night, not at an intersection, involving a single car with a young driver who was not undertaking a manoeuvre, but going ahead on a bend with a degraded road surface (defects or contaminants), when compared to other accidents.

The in-depth results by the WP5 method applied on the OTS data revealed that there was not one typical failure generating scenario for the road users where road layout was a contributory factor to the accidents.

For primary active road users, there were 2 most frequent typical failure generating scenarios in the sample. The first involved a failure to judge the bend ahead (i.e. tighter than expected), and combined with the road users' risk taking actions and other factors (e.g. alcohol, fatigue, little driving experience and poor road surface), led to the road user losing control. Or, after evaluating correctly the bend ahead, the second scenario involved a failure in deciding how to negotiate the bend correctly (i.e. intentional risk taking), which coupled with other factors, led to a loss of control. There was found to be a close link with risk taking, lack of driving experience and also visibility issues (related to road geometry issues) when negotiating bends.

For the non primary active road users in 'road layout as a factor' accidents, it was their failure to expect that another road user in their view would undertake an erroneous manoeuvre that mainly led to the accident occurring (i.e. it was too late avoid by the time the rupture phase occurred).

From the comparison with the WP8 results also the findings from the in-depth VSRC analysis might only be partly possible to transfer to the Czech Republic and Italy.

5 Discussion, Conclusion and Suggestions for Prevention

The analyses performed for task 3.3 were aimed at achieving more knowledge on certain types of accidents, namely, accidents that are caused by selected trip-related factors. The following contributing factors on a trip level were chosen: alcohol, vigilance, experience, vehicle condition, road condition and layout.

The expected results should give an idea how the accidents can be characterised and on the other hand on how to prevent these accidents. Prevention measures can always be on an educational and regulatory (control and law enforcement) level including target groups as defined by social characteristics e.g. (see also D3.2 (Engel, 2008) of the TRACE Project), on a vehicle level (active and passive safety features, see also Deliverables D6.1 (Barrios et al., 2007) and D4.1.5 (Van Elslande et al., 2008) of the TRACE Project) and on an environmental (infrastructure and traffic) level.

By analysing explanatory variables as circumstances for the selected contributing factors more focussed prevention efforts can be recommended.

The circumstances of accidents as described by explanatory variables comprise time (e.g. advice when to intensify prevention efforts), place (e.g. sites for controls in general, sites for infrastructural improvement), situations/manoeuvres/scenarios (which active safety device could be apt) and target groups (drivers and vehicles).

Depending on the results only limited but reliable suggestions can be given for most of the analysed factors. The active safety systems suggested are taken from the list as presented and evaluated by the aforementioned D6.1 and D4.1.5.

In the combination – high risk and high frequency – alcohol is regarded as a relevant and important accident related factor by increasing the risk and contributing to the occurrence of accidents which had been shown by task 3.1. Already on a legal level (depending on country) below 0.5% the crash risk was found to be 3 times increased. Depending on the database alcohol was found in 4% up to 19% of accidents in the national databases and in 0% up to 13.7% in in-depth databases of those countries.

To prevent accidents caused by alcohol some general suggestions are well-known e.g. Alcolock systems to prevent drunk driving in the first. In D4.1.5 a response efficiency of 98.5% was estimated for this feature. Another general prevention recommendation is to conduct more controls for drunk driving by the Police. The results of task 3.3 show, that controls would be especially effective in certain circumstances. The circumstances comprise time (advice when to intensify controls), place (sites for controls in general), and target groups (drivers and vehicles). Educational effort by e.g information campaigns to change behaviour and reduce the habit of drunk driving can be focussed on certain target groups, in which the social norm accepts drunk driving (see D3.2).

From the BASt analysis it can be concluded, that in Germany alcohol related vehicle accidents would be best prevented by controls on weekends, sites for controls should be before "leaving the road accidents" can occur (recommendable is within city limits or close to discotheques etc. and the target group for controls should focus on males. From the vehicle side active safety features preventing running off the road would be beneficial to prevent alcohol related accidents, especially Intelligent Speed Adaption (ISA) on a mandatory level, but maybe also Lane Keeping Assistance and Electronic Stability Program (ESP) are suspected to be of benefit here. Prevention campaigns could focus on male unemployed persons. In Germany 8.3% of the accidents show the contributing factor alcohol, although this factor is usually not coded as a primary causative factor. Comparable suggestions can be given for the Czech Republic, France, Italy, and the UK.

The TUG analysis shows, that in Austria fatal alcohol related vehicle/van/PTW and truck accidents of males would be most effectively prevented by controls during the early evening hours (after 4 pm during daylight). The most effective sites would be not country roads or motorways but other roads. Controls could effectively focus on cars/vans. A specific target group could not be worked out, except that males should be addressed by educational efforts. Further, no specific manoeuvres or situations were found thus no recommendation on active or passive safety features in vehicles can be recommended to prevent alcohol related fatal accidents from this analysis point of view. 11.9% of the fatal accidents in Austria are contributed by alcohol, showing the importance of prevention action. Comparable suggestions might especially apply to the Czech Republic and Italy.

And from the VSRC analysis we learn that alcohol controls for preventing traffic accidents in the UK would be most effective if focussing on minor urban roads, in particular during more quiet times during darkness. As alcohol related accidents are more frequent in low speed limit zones, in bends and are more often single car accidents without specific manoeuvre also the suspicion arises that unadapted speed might have additionally contributed. Again ISA on a mandatory level, Lane Keeping Assistance, and ESP might have prevented these accidents. Further, the combination of "single car accidents" and "car vs. pedestrian accidents" with "frontal impacts" might give rise to the suggestion that Brake Assist, Active Cruise Control (ACC), and Collision Avoidance could be of benefit. Also here comparable suggestions might be transferable partly to Germany, to France, the Czech Republic and Italy.

In addition the in-depth case analysis by the VSRC shows that alcohol related accidents often also concern drunken pedestrians. In-depth analysis of fatal pedestrian accidents for WP1 task 1.4 also showed for Germany that alcohol plays a major role here. So further suggestions for prevention is necessary, like e.g. better road safety education for pedestrians when out at night and alcohol impaired or better separation of traffic for different road users. Further, from the vehicle side Pedestrian detection & avoidance systems like SAVE-U (Vulnerable Road Users Protection) or even also Night Vision could help to reduce these kinds of accidents. From the OTS analysis for task 3.1 it is known that in 7.8% of the accidents alcohol was contributing.

Vigilance is influenced by alcohol, so the analysis of vigilance itself as contributory factor is of importance in regard to preventive measures. Most often vigilance is viewed in terms of low vigilance and especially fatigue, although an alteration in "normal vigilance" can also comprise a state of hyperexcitation, which also reduces the driving capability. As shown in D3.1, "Fatigue" as a risk factor is found in literature to increase the risk for accidents of about 2 to 5 times; the frequency of "Fatigue" as contributing factor in databases available to the TRACE Partners lies between 0.1% and 15% of accidents.

The in-depth analysis of vigilance related accidents by INRETS shows that alcohol is of important influence for those kinds of accidents. So, there is no wondering that for preventing vigilance related accidents Alcolock Key can be recommended as well. Further, the analysis reveals that prevention of vigilance related accidents is not limited to active systems like Driver Drowsiness Detection. The different scenarios found give hints that features like ISA, ESP, and Lane Changing Assistance might also be apt for preventing vigilance related accidents. Target groups for educational campaigns should clearly separate one group of younger drivers with alcohol involvement in a festive context, a second group of around 40 year olds with chronic alcohol consumption problems, and elderly people with cognitive slowdown and fatigue. As in about 20% of the accidents of the database low vigilance shows up as an explanatory element, the importance of prevention efforts is clear. Only the statistic data from Italy give an indication for possible transfer of these suggestions.

From the CIDAUT analysis of the factor vigilance it has to be concluded that vigilance related accidents are predominantly a problem on monotonous roads like highways without intersections during the light condition of dawn. Not specifically connected with these accidents are certain driver types like professional drivers, or to truck and bus drivers only. Also, no specific age, gender, employment type or nationality is more frequently involved in vigilance related accidents than in other types of accidents. Active safety systems that were already installed in the vehicles were not able to prevent especially vigilance related accidents, but seemingly other types of accidents. For prevention by information/education like campaigns especially highways might be a site most effective, as no specific target group could be established by person characteristics. Also from an infrastructural prevention approach highways might bear the highest benefit if monotony could be reduced by geometry and layout and lighting improved. Here also speed limit changes provided by variable message signs of traffic management systems (that usually only coordinate traffic flow) might be helpful. From active safety measures in vehicles of course Drowsy Driver Detection systems can be recommended, but also Lane Keeping Assistant and Night Vision and Advanced Adaptive Front Light System might be beneficial. Best transfer of these results is possibly applying to the UK.

The analysis on the factor "experience" was tried by CIDAUT. Unfortunately here no new suggestions could be extracted. Experience is obviously a factor for young drivers. Intensifying of driving licence driving lessons and some graduated driver licensing programs are thought to be beneficial in general, but not specifically for this type of accidents only. As experience is contributing in around 4% of the accidents in Spain, and between 1.3% and 6.6% of the national databases available to the TRACE Partners (see D3.1) and also in 12% of in-depth analysed Truck Accidents more research would be necessary where to put effort in preventing experience related accidents.

Accidents where the vehicle condition contributed have been analysed by BASt for Germany. Prevention measures in Germany seemingly don't have to focus on more regular checks for older cars. Obviously the existing mandatory checks are sufficient in this view, as a specific age group of the vehicle was not overrepresented in these types of accidents. A target group for campaigns picturing the need for regular technical checks, especially for the tyre condition, might be unemployed drivers, where the probable lack of financial capacities might be the reason for not keeping the vehicle maintained. In general, which is also mentioned in the efficiency analysis in D4.1.5, the educational advertising has to picture the dangers stemming from bad vehicle conditions and tyre conditions, respectively. Regular traffic checks by the Police might possibly be intensified for also checking the maintenance status of the vehicle, and not only focus on drunken driving/license/safety equipment. The site for controls with this focus might be before the entering of highways and other roads with higher speed limits.

The analysis performed by CIDAUT indicates that controls as well as maybe more regular mandatory checks would be efficient if focussing on commercial trucks. Interesting is the fact that a certain day of the week was found to be overrepresented for accidents where the vehicle condition contributed. Assuming regular voluntary checks this might indicate that either distance travelled or time since check need to be reduced for frequency of more regular checks.

For both analyses it can be stated that from the vehicle side of course tyre pressure monitoring and warning systems can help to prevent accidents where the tyre condition was contributing. In up to 8% of the accidents analysed by the TRACE Partners (see D3.1) a bad tyre condition was contributing.

A transfer to the other countries as represented by the WP8 request is not possible.

For the analysis of accidents where the road condition contributed by BASt the following prevention measures can be recommended. Improvement of road maintenance efforts should focus especially on rural sites without traffic regulation. As "road condition" implies a variety of different variables (road layout, maintenance of infrastructure etc.) no specific recommendation for vehicle active safety systems can be derived. It would not be effective to focus on educational information to certain target groups (like informing about the difficulties and influences of road condition contributing to accidents e.g. during driving lessons) as no specific age/gender/driver group is especially affected by road condition as an accident factor. As the databases of the TRACE Partners (see D3.1) have shown that bad road conditions contributed to up to 24% of the accidents, the need for improvement of road layout and road maintenance is given. Partly the pattern might be possible to transfer to Czech Republic, Italy and the UK.

The analysis by the VSRC on road layout reveals a target group of young drivers (<25years) for information campaigns on the danger of bends/steep hills and narrow roads. Sites for more signage and information would be most efficient for warnings and speed limit reductions in approaching of bends on minor, rural roads. As decision-making failures and diagnosis failures are most frequently found in accidents related to the road layout, also Driver Assistance Systems in vehicles can be effective. Especially Brake Assist, Collision avoidance, Collision Warning, ESP, ISA but also ACC, Night Vision, and Lane Keeping Assistance might be beneficial. As up to 12% of the accidents analysed by the TRACE Partners for task 3.1 show bends and view obstruction as contributing factor, the need for improvement is given, for the infrastructure and the roads' maintenance as well as the vehicles' and drivers' interaction possibilities with the difficulties met. The findings of the in-depth VSRC analysis might only be partly possible to transfer to the Czech Republic and Italy

The following two tables (5-1 and 5-2) shall give a short and therefore much generalised overview on the characteristics of accidents that are caused by the analysed trip-related contributing factors, and, in accordance, on the prevention measures that are thinkable to avoid accidents where these factors contributed to. Further, in table 5-2 the maximum relevance (frequency as found by the results of the data request 3A in task 3.1 of the TRACE Project) of the factors in the databases that are available to the TRACE Partners is documented.

contributing factor	who is predominantly affected	where is it predominantly contributing	when is it predominantly contributing	other circumstances predominantly occurring/present
alcohol	males, unemployed, pedestrians	urban (and rural), other/minor roads	weekend, after 16:00, darkness (but fatals at daylight conditions)	leisure trip, leaving the road, bends, no specific manoeuvre, unadapted speed in low speed limit zones, overall failures
vigilance (overview)	A) 28 to 31 year olds with alcohol consumption, B) 37 to 41 year olds with chronic alcohol/drug addiction, C) elderly with cognitive slowdown, D) overall	A) tendency for countryside, B) anyplace C) intersection, D) highways	A) night, B) anytime, C) daytime D) night	A to C) detailed scenarios - see INRETS report, D) high speed limit zones
experience	novice drivers	anyplace	anytime	anyhow
vehicle condition	trucks, tendency for unemployed, more than 1 passenger in passenger cars	highways/high speed limit zones	Indication for certain day of the week	main problem: tyres
road condition/lay out	<25 years old	rural, speed limit between 60 and 100km/h	winter, nighttime	driving accident, frontal impacts

Table 5-1 summary of characteristics for trip-related factors contributing to accidents

contributing factor	prevention by education/law enforcement (human) (target groups/sites/times)	prevention by (active) safety measures (vehicle)	prevention by improvement of infrastructure/ "environment"	% of accidents in databases available to the TRACE Partners affected by contributory factor
alcohol	A) controls on weekends, within city limits/close to places of alcohol consumption, of males; B) controls of males in passenger cars/vans from 16:00 until darkness on other roads than highways or country roads; C) at nights, minor inner-city streets, pedestrians	alcolock, ISA, LKA, ESP, BA, ACC, CA, SAVE-U, NV	speed limits more to be pronounced (reduced/warnings) before bends	up to 19%
vigilance (overview)	on highways, on countryside, different target groups	alcolock, DDD, ISA, ESP, LCA, AAFS	reduce highway monotony and improve lighting	up to 15%
experience	Graduated Driver Licensing Systems, increase driving lessons	no suggestions possible	no suggestions possible	up to 7%
vehicle condition	trucks, regular checks for tyre condition, controls before high speed limit zones	TPM	no suggestions possible	up to 8%
road condition/lay out	tendency for target group of younger drivers information campaigns	BA, CA, CW, ESP, ISA, ACC, NV, LKA	improvement of road maintenance in rural sites	up to 12%

Table 5-2 summary of preventive measures for trip-related factors contributing to accidents

Legend: ISA: Intelligent Speed Adaption, LKA: Lane Keeping Assistance, ESP: Electronic Stability Program, BA: Brake Assistance, ACC: Active Cruise Control, CA: Collision Avoidance, SAVE-U: Vulnerable Road Users Protection, NV: Night Vision, DDD: Driver Drowsiness Detection, LCA: Lane Changing Assistance, AAFS :Advanced Adaptive Front light System, TPM: Tyre Pressure Monitoring and Warning Systems, CW: Collision Warning

6 Concluding Summary and Outlook

Trip related factors are by definition acting for the whole trip someone is undertaking. Therefore it seems nearly obvious that these trip-related factors only very seldom lead to an accident all by themselves. Usually further factors are necessary letting a trip end with an accident. These factors can stem from the trip-level as well and increase the risk situation (like alcohol or vigilance together with the road layout) by summing and multiplying their attributing risk. Or only one further factor from the driving task level adds suddenly to this situation leading to an accident.

Factors on a trip level can imply different underlying factors which can be seen in the example vigilance. Fatigue and restrictions in the conscious arousal state by alcohol, medicines or other drugs are reasons for and expressions of low vigilance which develop to different scenarios associated to this factor.

To analyse what factors explain one trip-related factor and the circumstances of these factors occurring and leading to an accident leads to very detailed different scenarios. To analyse more detailed factors in the first seems to be advisable. However, on the one hand, if one trip level factor (also with a variety of factors implied) can be prevented by certain measures, then lots of underlying factors and scenarios stemming from this factor might be prevented as well. The best example for this is the alcolock key idea, namely, to prevent all accidents following from the abuse of alcohol (might the implicated factors be risk taking, speeding, low vigilance or reaction time).

The idea to analyse factors on a trip level was expected to lead to answers if certain trip related factors are typically occurring in certain objective accident circumstances as defined by person, vehicle, site, time and situation characteristics. If special characteristics were obtainable then special prevention measures would apply. This could only be confirmed partly.

Often the information of interest is either not available in the database, especially background factors like socio demographic information to focus on certain risk populations for prevention efforts, but also vehicle information like equipment is often not collected in the databases.

On the other hand it has to be accepted that accidents that are caused by certain trip-related factors are very often not that different from other accidents that are caused by other factors.

This is of course due to the trip level which is too general, but also due to the variety of other contributing factors necessary and maybe more typically describing a typical accident pattern. This might be shown in the analysis of driving task related factors.

The more detailed the accident causing factors will be pictured in databases, the more specific accident types will be found.

The only subjective judgement was taken from the database itself, as some accident investigator had to apply a causal contribution to one variable making it a contributing factor for an accident when establishing the traffic accident database in the first (and providing contributing factors for accident causation).

Some conclusions from the work performed by the Partners in task 3.3 are worth mentioning in general.

The advantage of the "statistical method" is that without exposure data typical pattern for certain contributing factors for traffic accidents can be derived. From the idea to compare different accidents, that are characterised by one contributing factors' presence or absence in these accidents, some general pattern can be found by the statistical method.

The disadvantages of this method are the necessary preparation of the database on the one hand, and on the other hand, the required statistical tools and knowledge which turned out to be not easy to apply for everyone. Further, a sufficiently high number of cases in the database is desirable to achieve valid and reliable results. Lastly, the interpretation is restricted to the analysed database.

The "WP5 method" is of course able to split a trip-related factor to underlying factors and find typical scenarios for underlying factors all describing circumstances for one trip-related factor. This method has a completely different approach and can therefore give answers to more detailed questions, than just the comparison of accidents with or without a certain trip-related factor. As this method was firstly applied on their own in-house database the conclusion drawn by the VSRC are worth mentioning: Although the samples were relatively small in the in-depth analysis, it was still possible, using the TRACE WP5 methodology, to identify a number of typical scenarios that road users are faced with when either alcohol impaired or negotiating a bend in the road (or are faced with an alcohol impaired road user or road user who has lost control on a bend) and the failures they encounter. It has therefore shown this methodology to be a useful tool in accident causation analysis.

The disadvantage of the method lies in the necessary case by case analysis that has to be performed and cannot simply be applied on existing databases. Further, more (than usually collected) detailed information like obtainable by interviews is needed for analysing cases by this method.

For the interpretation the data materials on which the analyses are performed have to be taken into account. For differing results between partners when analysing the same contributing factor, multiple explanations can be given. There may be real existing differences in the circumstances of accidents where certain trip-related factors contributed which might be due to differences of the countries the databases stem from including different laws, law enforcement habits, vehicle fleet, geography, and other explanations. Another explanation is coding instructions of variables, definition of factors, and sample criteria. E.g., obviously fatal accidents differ from "all kinds" of accidents, and accidents with "all kinds" of traffic participants to vehicle accidents only. Especially on the trip level the factors covered might be too general, covering a mixture of depending driving-task related factors. This can e.g. be seen by the multiple scenarios that are connected to vigilance related accidents.

This also leads to the question if by all the suggested countermeasures, accidents with certain trip related factors can be prevented at all. They might happen in cases like in alcohol induced hypovigilance situations, where e.g. alcohol could be eliminated (by alcolock key e.g.) but, nevertheless due to fatigue, risk taking and speeding or unadapted speed in curves a big share of those accidents might happen still.

The road layout analysis by VSRC shows something further: due to selection criteria (steep, narrow, bend) bends seem to hold the biggest share in these accidents, therefore accidents are again maybe associated to speed and comparable to the alcohol accidents and showing comparable explanatory variables to accidents where speed contributed. A coincidence of alcohol, speed and road layout all combining to typical accident situations has to be suspected

General statistics are not able to picture the scope of the accident problem, as the in-depth analyses show; different scenarios need different prevention measures and, as shown, "one typical factor" covers a range of different scenarios.

From the BASt analysis one further conclusion can be drawn: One condition which was significantly overrepresented in all investigated trip related accidents was that trip related accidents had more than one accident cause. The reason is that trip related risk factors always need at least one additional triggering factor to generate an accident.

For future analyses of this kind it would therefore be very advisable to take multiple trip-related and/or other contributing factors into account simultaneously instead of focusing on one contributing factor as was the viewpoint of WP3. Especially databases with coding and classification structures that on the one hand allow to code multiple contributing factors and are predominantly collecting factors on a trip level, have to take these considerations into account. Of course, the statistical methods for this kind of analyses would have to be performed by statistic experts.

In general the accident prevention has improved in the last decades, therefore every further preventive effort will have less additional effect and will have to focus on more specific issues which are by nature sub-groups and represented in lower shares.

The attempt of analysing accidents by a view point of contributing factors on a trip level reveals some general insights: on the one hand the trip level is too general for modern analysis, thus, sometimes only well-known results can be gained. Too general means that the factors on this level are the consequence of underlying background factors and in addition are themselves the reason for different subsequent factors that will be found on the driving task level. Factors from a trip level comprise a variety of different scenarios which are defined as combinations of certain road user, site, time, and place characteristics involved in situations, manoeuvres and in this combination leading to typical failures. General recommendations can thus be derived by analysing trip related factors, but, as they comprise a variety of implied aspects, no conclusions on the actual relevance of the factor itself, or the impact of the suggested preventive measures, can be drawn.

But, as can be seen by the existing coding structures of the databases available to the TRACE Partners, for factors, that are still collected and documented on a trip level, and show high representations in the databases, still results can be gained. For factors of lower representation in the databases also the analysis within task 3.3 cannot show evidence for any typical accident pattern connected to this factor (e.g. experience that is showing a low frequency in comparison to other factors, and the analysis was not able to give satisfying results). This means that when multiple implications and meanings are combined for forming one trip-related factor and a certain pattern is detected, a lot of impact can still be expected by preventive measures.

Two examples for clarification of this paragraph:

One example that has not been analysed because of the multiple a priori known implications is the factor "Weather condition". e.g. the parameter value "rain" implies effects in visibility due to the windscreen, wipers, but also visibility in the distance depending on the density of the rain, and the visibility of signs that might show different reflection characteristics when wet. In addition rain implies a wet road, even aquaplaning risk, or e.g. in combination with mud/sand/ice even more slippery road surface conditions. Further, the behaviour of different road users is affected differently (especially vulnerable road users tend to give priority to reaching their destiny to the disadvantage of safety). These aspects should be regarded separately when focussing on specific active safety measures. But, as mentioned above, only on the trip level these multiple implications are covered that give a chance to different prevention features from different directions.

Another example is the active prevention feature of ESP that can be suggested for alcohol related, vigilance related, and road layout related accidents. Further it will be preventive in speed associated accidents. The system itself will prevent vehicles from swerving, independent which factor on a trip level contributed to this situation. Alcohol on the other hand can lead to accidents that are not preventable by ESP as well.

Therefore, on a trip level no "One to One" translation of contributing factors to Safety Features is feasible. The advantage of preventing certain trip related factors (or the trip itself if the factor is present) in the first (more effect to be expected by law enforcement, controls, and education or features like alcolock in this special case) is that a bigger amount and variety of accidents can be prevented, than focussing on specific and detailed factors. The disadvantage is the effort that has to be put in this kind of prevention: Safety measures in cars will be an effort not by society, but by traffic participants/car owners, whereas education and law enforcement will go to the Common Budget.

Further, on a trip level the factors not only comprise multiple scenarios, also, interrelations between multiple factors are to be expected. E.g. evidence for alcohol, vigilance, speed and bends as showing up as combinations are found in task 3.3, even if trying to separate the factors for analysing accidents as done by task 3.3.

The data request towards WP8 to some TRACE Partners was limited to some bivariate analyses on some factors and chosen explanatory variables. These results can give a general overview on accidents associated with some trip related factors, but cannot give information on pattern or scenarios. But, nevertheless, the results are useful for the discussion if certain associations are found in other countries as well. Both methods used by the WP3 partners in task 3.3 are time-consuming and need thorough handling and statistic or detailed expert knowledge, so that a general request would have led to no or no reliable results.

A complete overview of the WP3 work and its impact on the prevention of traffic accidents in Europe by analysing accident causation from a factors point of view can only be given by taking into account the results of all tasks in WP3, and will be presented in D3.5 as a final conclusion.

7 Acknowledgements

The Trace Partners have access to national and in-depth databases. The results presented in this report are based on the work performed by the according organisations keeping the databases.

No guarantee can be given on the correctness of the interpretations of the results. The conclusions drawn might not reflect the views of the organisations and partners, respectively.

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STATS 19: National Accident Data for Great Britain are collected by police forces and collated by the UK Department for Transport. The data are made available to the Vehicle Safety Research Centre, Ergonomics and Safety Research Institute, at Loughborough University by the UK Department for Transport. The Department for Transport and those who carried out the original collection of the data bear no responsibility for the further analysis or interpretation of it.

In the early 1990s, the LAB (Laboratoire d'Accidentologie de Biomécanique et de comportement humain PSA Peugeot Citroën – Renault) pooled resources with the state-funded INRETS (Institut National de REcherche sur les Transports et leur Sécurité) in a common active safety research program – VSR (Véhicule et Sécurité Routière). 4 teams of investigators were called out to injury accident scenes by the emergency services to collect real-time crash data (approximately 60 accidents per team per annum). In 1999, at the end of this joint program, the two partners chose different but complementary directions. The LAB began to evaluate the effectiveness of new safety systems, whereas the INRETS continued developing its driver failure model. The LAB has since adopted this model and included it in the ongoing in depth accident investigation program.

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Annex I request 3B and Method of data preparation of replies 3B

The data request criteria are pictured the following (example "alcohol" is presented):

- one driver per one vehicle (if appropriate) per one accident, No multiple counts per accident.

- It should be the driver to whom the contributory factors were applied to. For alcohol, experience, vigilance, vehicle condition it should be possible that they are attached to one driver, for road layout it might be a bit more difficult. If those factors are only connected with the accidents, then the driver number 1 in the database in this accident should be taken or a random choice might be feasible. If the database structure cannot provide a valid way to structure it like this - then the data is not applicable to this data request.

- In a pedestrian accident where the pedestrian is to blame the alcohol refers to the pedestrian.

- all injury accidents (including fatals)

- if possible dichotomize or categorize as shown in example tables for parameter values

- 2004 onwards to present (2004 included)

- please exclude missings

- "Alcohol has to be documented by police or investigator, to be contributory to the accident. The alcohol level does not have to be 'over the legal limit'.

- All requested tables 1_1 to 5_2 should refer to one sample: the sample of all (injury) accidents for which information is given if the contributory (alcohol, experience…) factor was coded for this accident or not.

1. Frequency distribution of parameter values in the accidents of the databases

Title of Table 1_1: gender distribution of drivers/riders (responsible for accident) in accidents

Gender	INRETS	Czech national	OTS	GIDAS	BASt	DIANA	LAB	ELASIS
male	72%	82%	73%	69%	67%	87%	65%	76%
female	28%	18%	27%	31%	30%	13%	35%	24%
sum	100%	100%	100%	100%	96%	100%	100%	100%

*missings fill up sum to 100%, other databases excluded missings

Title of Table 1_2: age distribution of drivers/riders (responsible for accident) in accidents

Age group	INRETS	Czech national	OTS	GIDAS	BASt	DIANA	LAB	ELASIS
<25	28%	26%	33%	27%	28%	11%	29%	17%
25-44	40%	47%	41%	36%	36%	61%	43%	53%
45-64	22%	22%	18%	25%	22%	24%	16%	23%
>65	11%	5%	7%	11%	10%	4%	12%	7%
sum	100%	100%	100%	100%	95%	100%	100%	100%

*missings fill up sum to 100%, other databases excluded missings

Title of Table 1_3: occupation distribution of drivers/riders (responsible for accident) in accidents

occupation	INRETS	Czech national	OTS	GIDAS	BASt	DIANA	LAB	ELASIS
worker/employee	52%	not provided	not provided	55%	not provided	68%	86%	not provided
housework		not provided	not provided	2%	not provided	0%	0%	not provided
student	14%	not provided	not provided	19%	not provided	1%	10%	not provided
pensioner	13%	not provided	not provided	16%	not provided	3%	0%	not provided
unemployed	10%	not provided	not provided	5%	not provided	1%	3%	not provided
other	11%	not provided	not provided	2%	not provided	27%	1%	not provided
sum	100%			100%		100%	100%	

Title of Table 2: vehicle (driven by driver/rider) distribution of drivers/riders (responsible for accident) in accidents

Vehicle group	INRETS	Czech national	OTS	GIDAS	BASt	DIANA	LAB	ELASIS
Car, Van, <3.5t	73%	73%	75%	66%	72%	51%	99%	67%
truck >3.5t	8%	9%	5%	6%	4%	17%	0%	1%
PTW	12%	6%	8%	7%	8%	31%	0%	21%
pedestrian	4%	0%	7%	7%	3%	0%	0%	5%
bicycle	3%	10%	3%	14%	10%	0%	0%	4%
Other	0%	3%	1%	0%	3%	1%	1%	3%
sum	100%	100%	100%	100%	100%	100%	100%	100%

Title of Table 3_1: impact type (first impact) of vehicles hitting another vehicle - distribution of accidents

impact type multiple vehicle collision	INRETS	Czech national	OTS	GIDAS	BASt	DIANA	LAB	ELASIS
frontal	50%	12%	52%	49%	12%	12%	52%	4%
side	20%	25%	36%	27%	6%	48%	43%	61%
rear	9%	10%	3%	4%	22%	33%	0%	24%
Other	20%	52%	8%	20%	60%	6%	5%	11%
sum	100%	100%	100%	100%	100%	100%	100%	100%

Title of Table 3_2: crash type single vehicle - distribution of accidents

crash type single vehicle	INRETS	Czech national	OTS	GIDAS	BASt	DIANA	LAB	ELASIS
running off the road	not provided	14%	not provided	41%	52%	5%	56%	67%
hitting object (immobile)	not provided	21%	62%	51%	18%	52%	2%	26%
hitting object (mobile -e.g. animal)	not provided	65%	1%	2%	1%	1%	2%	6%
rollover	not provided	0%	9%	5%	1%	42%	40%	0%
PEDESTRIAN (OTS)/Other (BASt)			28%		28%			
sum		100%	100%	100%	100%	100%	100%	100%

Title of Table 3_3: manoeuvre distribution of accidents

manoeuvre	INRETS	Czech national	OTS	GIDAS	BASt	DIANA	LAB	ELASIS
going straight	66%	not provided	30%	46%	not provided	52%	53%	34%
GOING AROUND BEND			17%					
changing lane	6%	not provided	4%	3%	not provided	0%	2%	0%
overtaking	6%	not provided	5%	2%	not provided	3%	10%	1%
turning	14%	not provided	20%	25%	not provided	3%	10%	5%
U TURN			1%					
crossing	2%	not provided	4%	7%	not provided	0%	22%	45%
merging	5%	not provided	2%	4%	not provided	0%	0%	1%
other		not provided	17%	12%	not provided	41%	4%	13%
sum	100%		100%	100%		100%	100%	100%

Title of Table 4_1: location distribution of accidents

Location	INRETS	Czech national	OTS	GIDAS	BASt	DIANA	LAB	ELASIS
Rural	61%	38%	45%	23%	33%	90%	62%	8%
Urban	39%	62%	55%	77%	67%	10%	38%	92%
sum	100%	100%	100%	100%	100%	100%	100%	100%

Title of Table 4_2: road type distribution of accidents

Road type	INRETS	Czech national	OTS	GIDAS	BASt	DIANA	LAB	ELASIS
Autobahn, National road	24%	2%	16%	18%	26%	43%	24%	9%
Country road	15%	23%	30%	19%	22%	0%	64%	86%
Other roads	61%	76%	54%	63%	52%	57%	12%	5%
sum	100%	100%	100%	100%	100%	100%	100%	100%

Title of Table 4_3: speed limit distribution of accidents

Speed limit	INRETS	Czech national	OTS	GIDAS	BASt	DIANA	LAB	ELASIS
<50	37%	not provided	45%	13%	5%	1%	1%	not provided
50-100	61%	not provided	39%	79%	20%	58%	92%	not provided
>100	2%	not provided	16%	8%	4%	41%	6%	not provided
sum	100%		100%	100%	29%	100%	100%	

*missings fill up sum to 100%, other databases excluded missings

Title of Table 5_1: light condition distribution of accidents

light conditions	INRETS	Czech national	OTS	GIDAS	BASt	DIANA	LAB	ELASIS
dark	18%	26%	27%	17%	22%	17%	22%	17%
dusk/dawn	3%	4%	7%	8%	5%	3%	4%	10%
day	79%	70%	66%	75%	73%	80%	75%	73%
sum	100%	100%	100%	100%	100%	100%	100%	100%

Title of Table 5_2: time of day distribution of accidents

time of day	INRETS	Czech national	OTS	GIDAS	BASt	DIANA	LAB	ELASIS
0-7:59	6%	18%	11%	15%	15%	13%	11%	18%
8-15:59	65%	44%	46%	49%	47%	62%	58%	46%
16-23:59	29%	38%	42%	37%	38%	24%	32%	37%
sum	100%	100%	100%	100%	100%	100%	100%	100%

2. Example for alcohol for database OTS for vehicle type/traffic participation

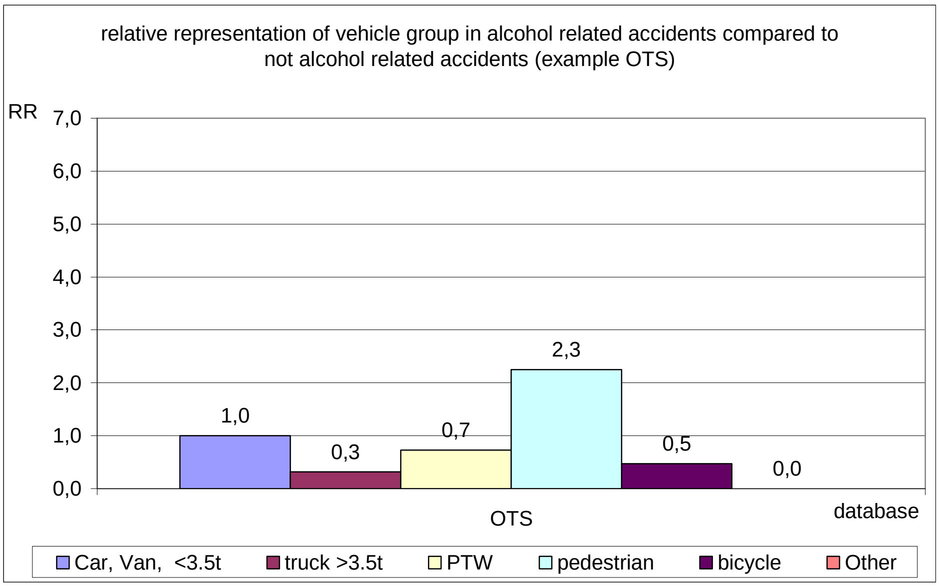
Raw table – reply to request

Vehicle group	Alcohol	Not alcohol	Sum
Car, Van, <3.5t	91	1429	1520
truck >3.5t	2	100	102
PTW	7	151	158
pedestrian	19	133	152
bicycle	2	67	69
Other	0	27	27
sum	121	1907	2028

Calculation of relative representation for screening – interpretation in this example: the percentage of pedestrians in alcohol related accidents is 2.3 times higher than in accidents where alcohol didn't contribute

$RR_{car,van<3.5t} = (91/121) / (1429/1907) = 1{,}0004$

$RR_{pedestrian} = 19/121/(133/1907) = 2{,}25$



Calculations of frequencies

Vehicle group	Alcohol %	95% CI lower limit	95% CI upper limit	Not alcohol %	95% CI lower limit	95% CI upper limit	Sum %	95% CI lower limit	95% CI upper limit
Car, Van, <3.5t	**75%**	67%	83%	**75%**	73%	77%	**75%**	73%	77%
truck >3.5t	**2%**	0%	6%	**5%**	4%	6%	**5%**	4%	6%
PTW	**6%**	2%	12%	**8%**	7%	9%	**8%**	7%	9%
pedestrian	**16%**	**10%**	**23%**	**7%**	**6%**	**8%**	**7%**	**6%**	**9%**
bicycle	**2%**	0%	6%	**4%**	3%	4%	**3%**	3%	4%
Other	**0%**	n.e.	3%	**1%**	1%	2%	**1%**	1%	2%
sum	**100%**			**100%**			**100%**		

By comparing these frequencies and the Relative Representations as screening method one parameter value (in example; pedestrian) was chosen for testing (Chi-square); results are provided as Odds Ratios with 95% Confidence intervals.

3. Calculation of OR – see example above

OR = [19 * (1907 – 133))]/ [133 * (121-19)] = 5,82

95% Confidence Interval (test based – Miettinen) [4,5; 12,4]

Interpretation

If an alcohol related accident occurred the chances that a pedestrian was involved is 5.8 times higher compared to accidents where alcohol was not contributing.

Annex II Alcohol

Alcohol – data request 3A result

Descriptive, contributing factor alcohol in accidents

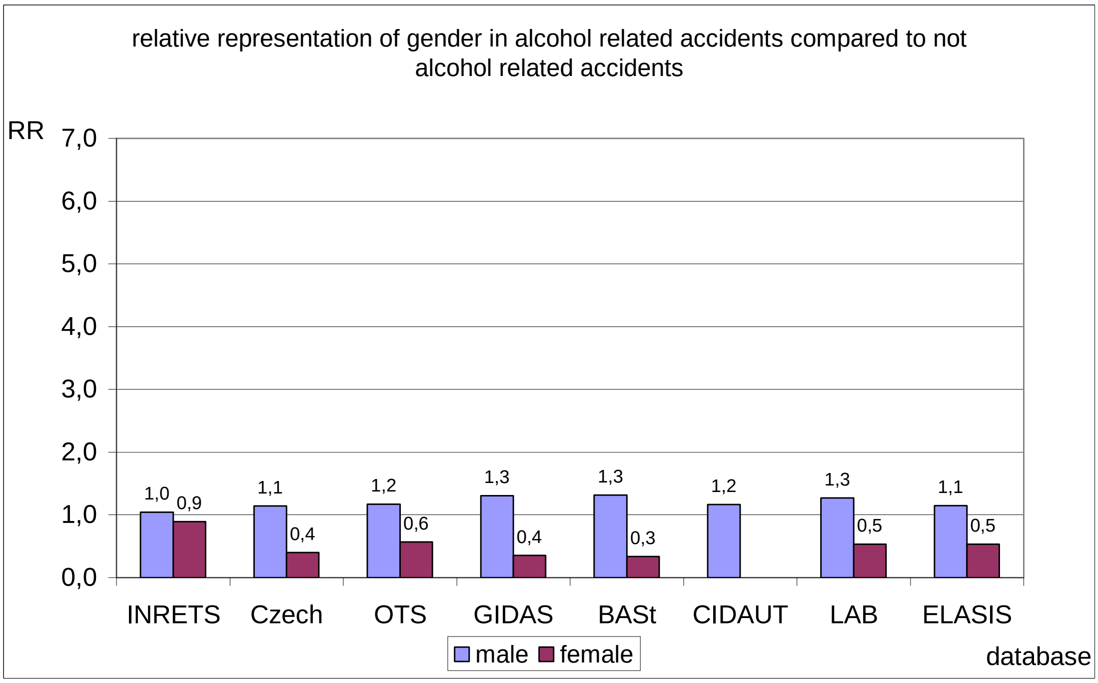
database	% of accidents in data sample	exact variable name
DIANA	0%	alcohol
IDIADA ETAC	0%	alcohol impairment
SISS ELASIS	1.2%	alcohol
GIDAS BASt	1.6%	alcohol
TNO MAIDS 2001	2.7%	alcohol impairment
TNO TRUCKS	4.0%	drugs/alcohol
CIDAUT	4.0%	alcohol or drugs
INRETS	4.7%	High level of alcohol impairment (BAC > 1,5 g/l) or other illegal or legal drugs
STATS 19	5.4%	impaired by alcohol
TNO MAIDS 2000	6.2%	alcohol/drug involvment
OTS	7.8%	impairment through alcohol
BASt	8.9%	Influence of alcohol
HIT	12%	alcohol use
LAB	13.7%	alcohol impairment
TNO EACS	15%	alcohol/drug involvement
Czech Republic	19.0%	under influence of alcohol

Relative over-representation (RR) in database (for all accidents and fatal accidents only)

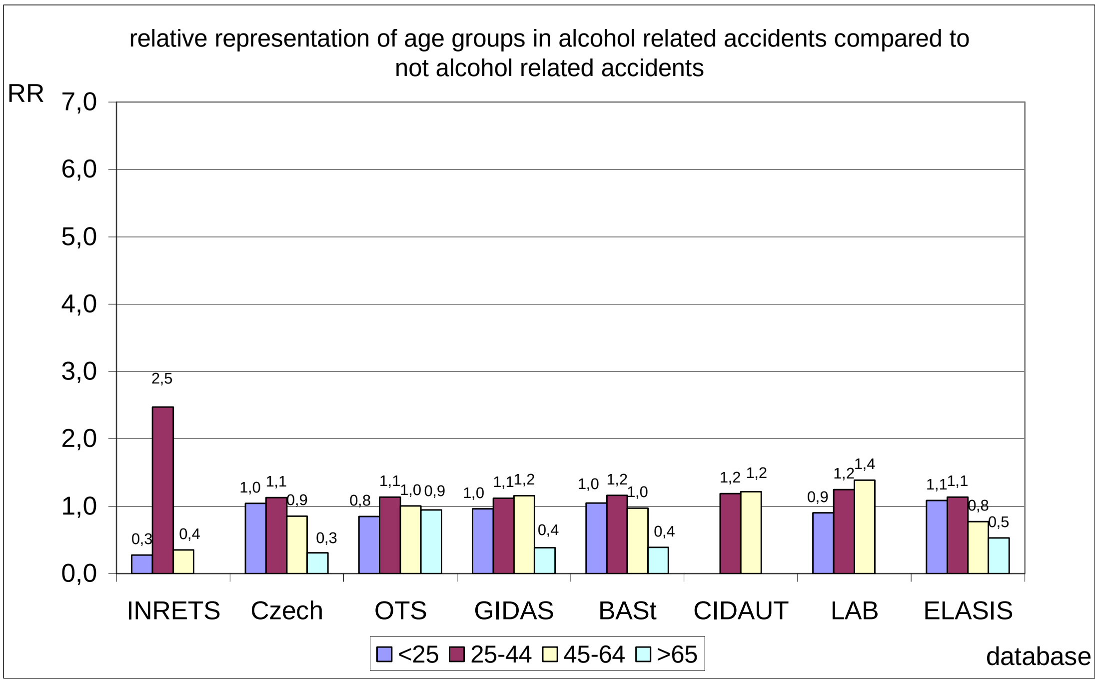
database	Contributory factor reported in accident	RR	
Monash_Australia_in-depth	Alcohol intoxication - the fact that the roaduser is intoxicated is not always a contributing factor (see notes)	9,4	fatal RR
LAB_in-depth	Alcohol impairment	9,0	fatal RR
Czech_national	under influence of alcohol	6,9	RR
GIDAS_in-depth	alcohol	5,7	fatal RR
BASt_Germany_national	01 Influence of alcohol	5,4	fatal RR
LAB_in-depth	Alcohol impairment	5,4	RR
Czech_national	under influence of alcohol	5,0	fatal RR
BASt_Germany_national	01 Influence of alcohol	3,9	RR
Monash_Australia_in-depth	Alcohol + other drug affected - includes prescription and non-prescription drugs; includes any level of canabis when combined with alcohol	3,3	fatal RR
Stats_GB_national	Impaired by alcohol	2,9	fatal RR
Saxony_fatals_in-depth	Accident with alcohol involvement	2,3	fatal RR
OTS_in-depth	Impairment through alcohol	2,2	fatal RR
SISS_Italy_in-depth	Alcohol	2,0	fatal RR
Stats_GB_national	Impaired by alcohol	1,8	RR
GIDAS_in-depth	alcohol	1,7	RR
TUG_Austria_in-depth	Substances taken - Alcohol	1,6	fatal RR
OTS_in-depth	Impairment through alcohol	1,3	RR
Stats_GB_national	Impaired by alcohol	1,3	fatal RR
BASt_Germany_national	56 Influence of alcohol	1,3	fatal RR
HIT_in-depth	Alcohol use	1,2	RR
SISS_Italy_in-depth	Alcohol	1,1	RR

Alcohol and explanatory variables

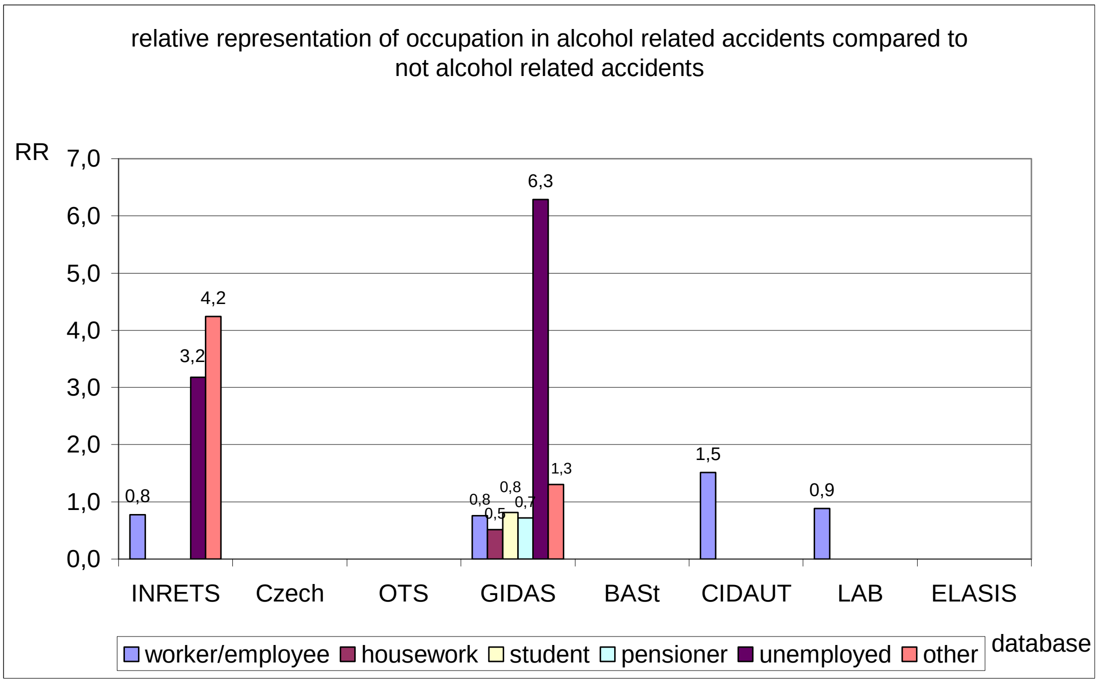
Data request 3B: results of preparation and Relative Risks in Comparison of the databases (graph - screening) and calculation of OR with 95% Confidence intervals (only significant (level 0.05) results are presented) (table)



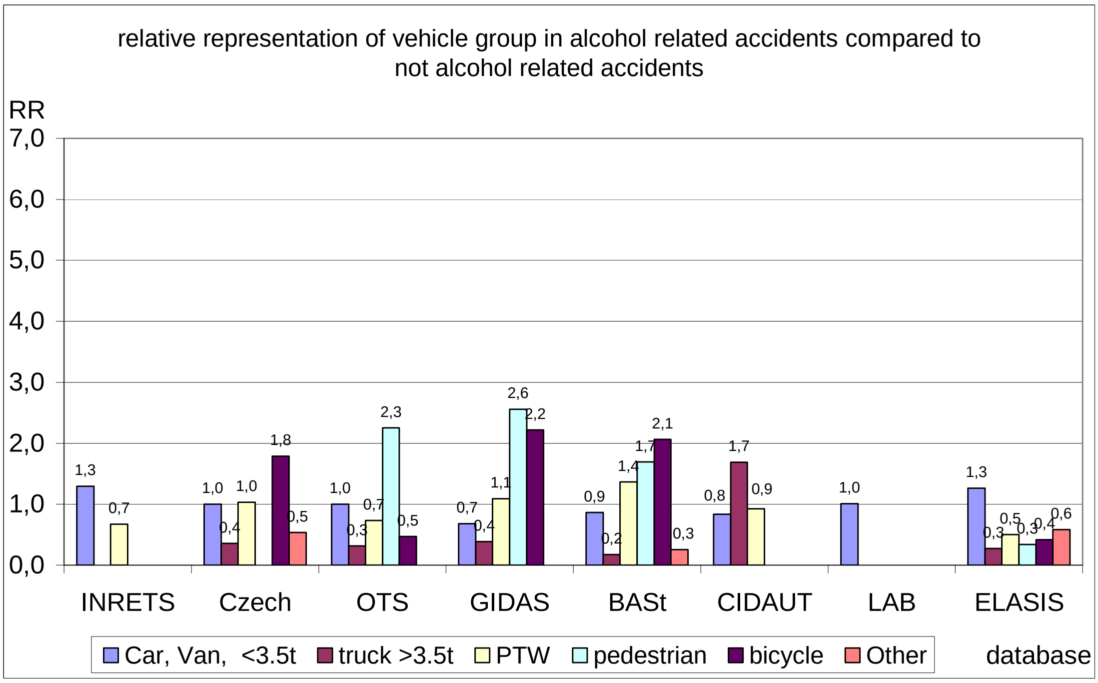
database	Gender	OR	95% CI lower limit	95% CI upper limit
OTS	male	2,07	1,25	6,53
Czech	male	2,83	2,66	6,10
GIDAS	male	3,70	2,50	10,33
BASt	male	3,92	3,82	7,89
LAB	male	2,39	1,09	11,40
ELASIS	male	2,14	1,83	4,83



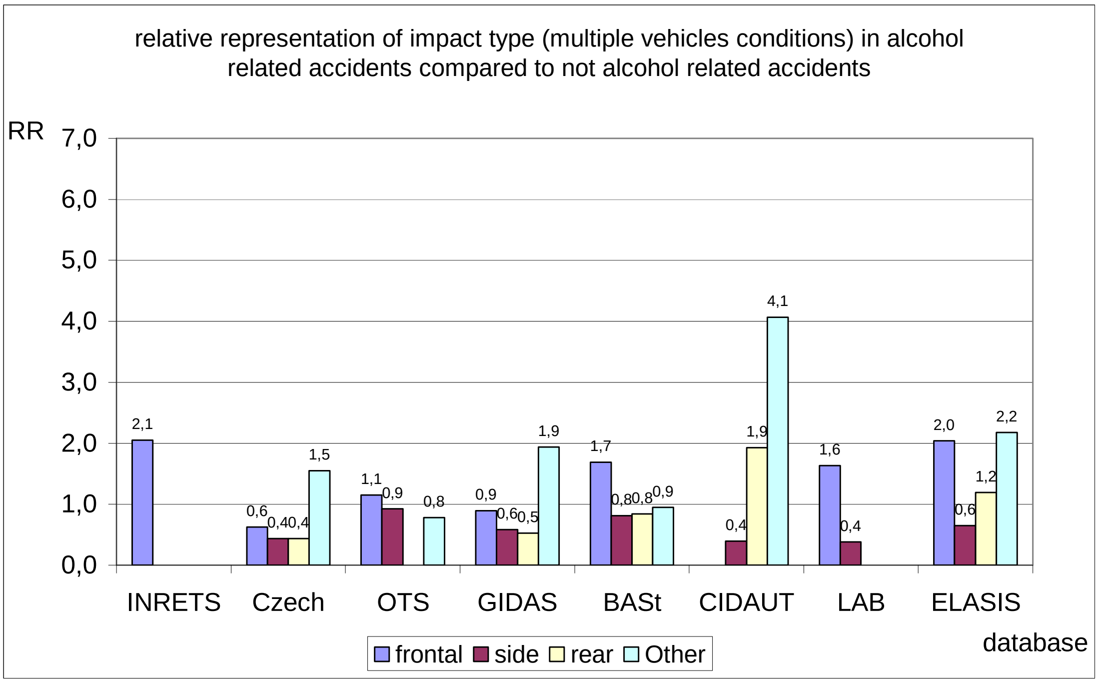
database	Age group	OR	95% CI lower limit	95% CI upper limit
Czech	>65	0,30	0,00	0,34
BASt	25-44	1,38	1,35	2,19
INRETS	25-44	10,0	2,2	74,9



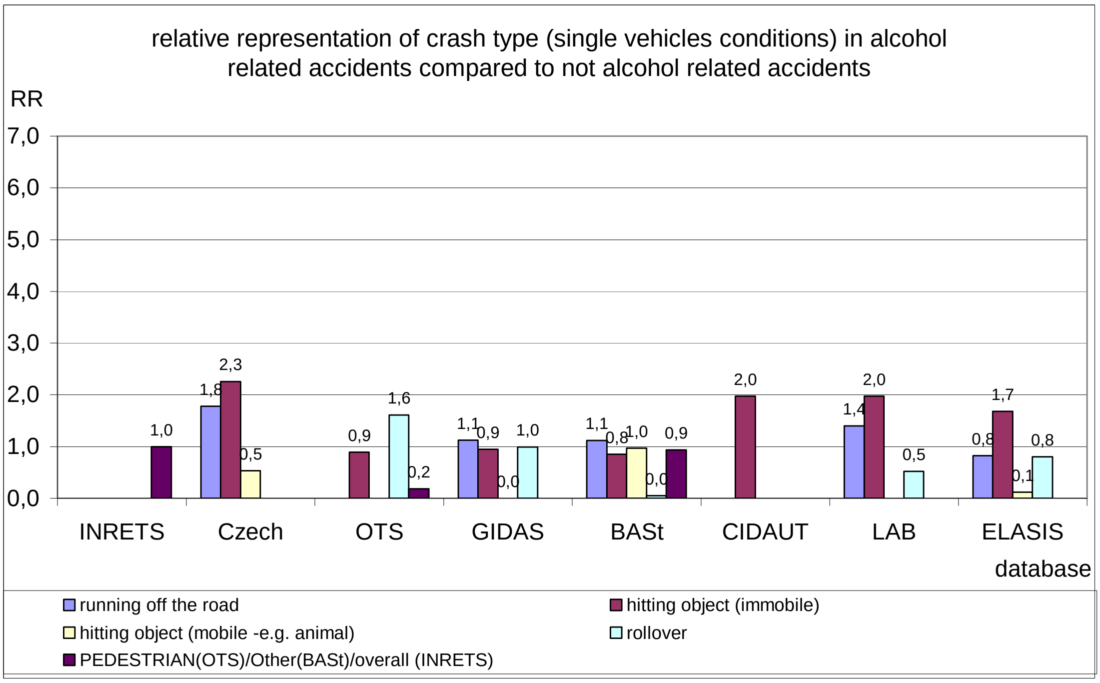
database	occupation	OR	95% CI lower limit	95% CI upper limit
GIDAS	unemployed	8,17	5,57	17,09



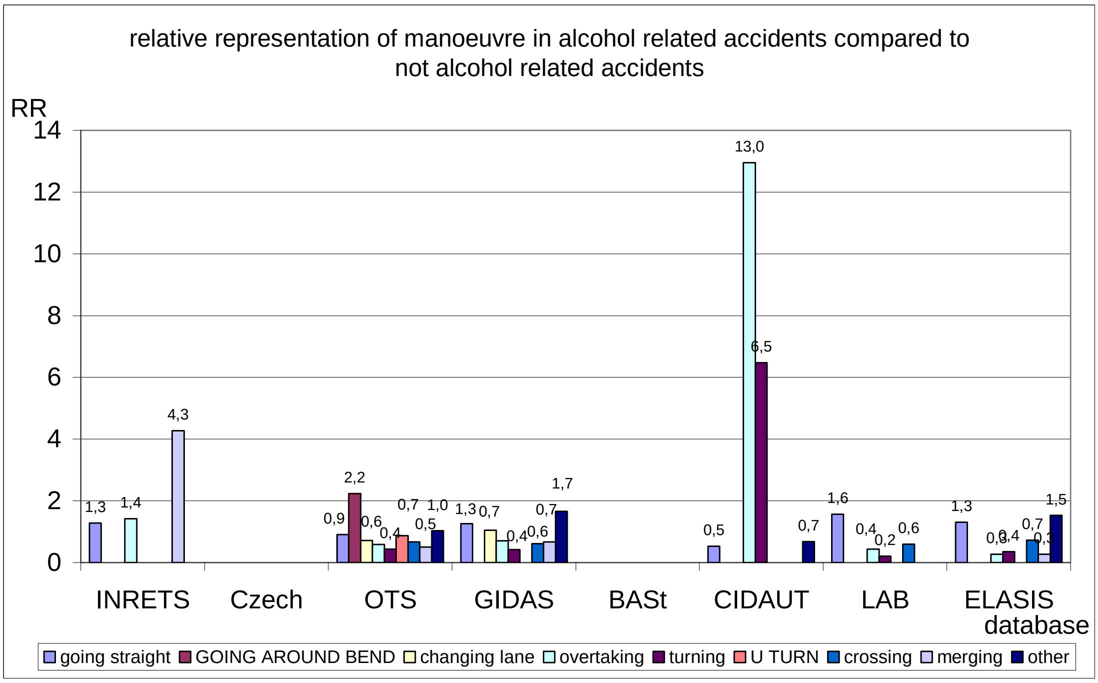
	Vehicle group	OR	95% CI lower limit	95% CI upper limit
Czech	bicycle	1,93	1,83	3,90
BASt	bicycle	2,33	2,29	4,83
OTS	pedestrian	2,48	1,46	8,43
GIDAS	bicycle	2,70	2,01	7,10
GIDAS	pedestrian	2,86	1,98	8,06
ELASIS	Car, Van, <3.5t	2,69	2,35	6,14



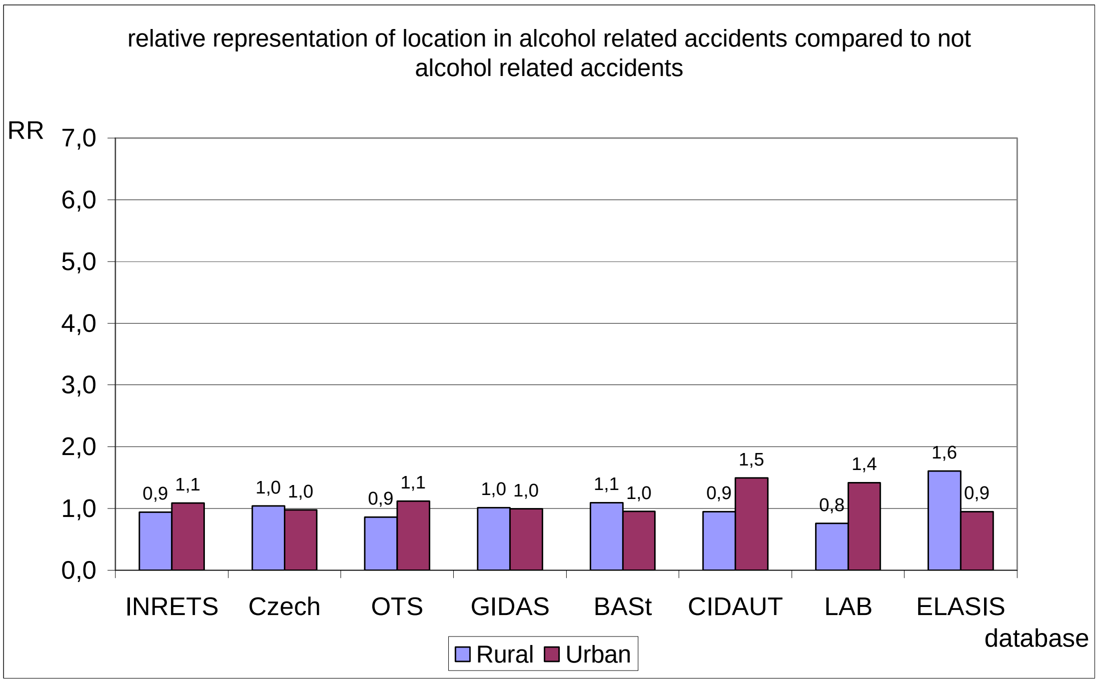
	impact type multiple vehicle collision	OR	95% CI lower limit	95% CI upper limit
BASt	frontal	1,85	1,79	3,64
GIDAS	Other	2,51	1,66	7,44
Czech	Other	3,21	3,09	6,74
ELASIS	Other	2,53	2,05	6,13



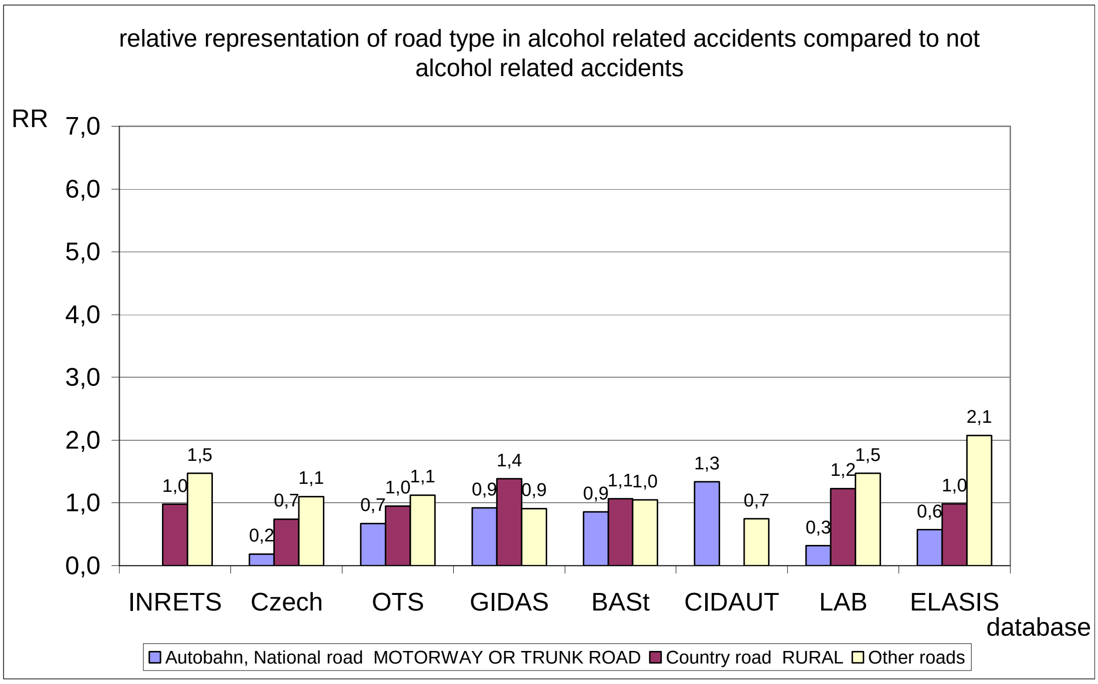
	crash type single vehicle	OR	95% CI lower limit	95% CI upper limit
BASt	running off the road	1,26	1,23	1,83
Czech	running off the road	2,01	1,92	4,09
OTS	rollover	2,06	1,14	7,13
LAB	running off the road	2,54	1,15	12,47
Czech	hitting object (immobile)	3,10	2,99	6,52
ELASIS	hitting object (immobile)	2,20	1,72	5,39



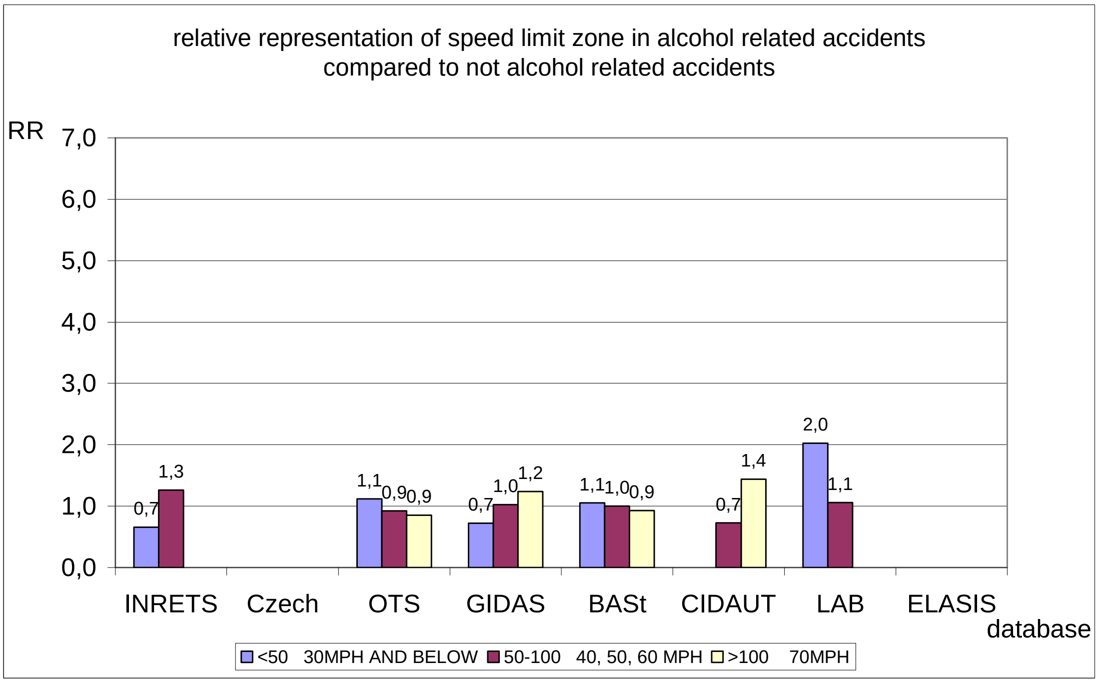
	manoeuvre	OR	95% CI lower limit	95% CI upper limit
ELASIS	going straight	1,56	1,39	2,93
GIDAS	going straight	1,62	1,18	3,60
OTS	GOING AROUND BEND	2,92	1,92	8,73
LAB	going straight	3,84	1,84	16,09
DIANA	overtaking	17,73	2,11	255,82



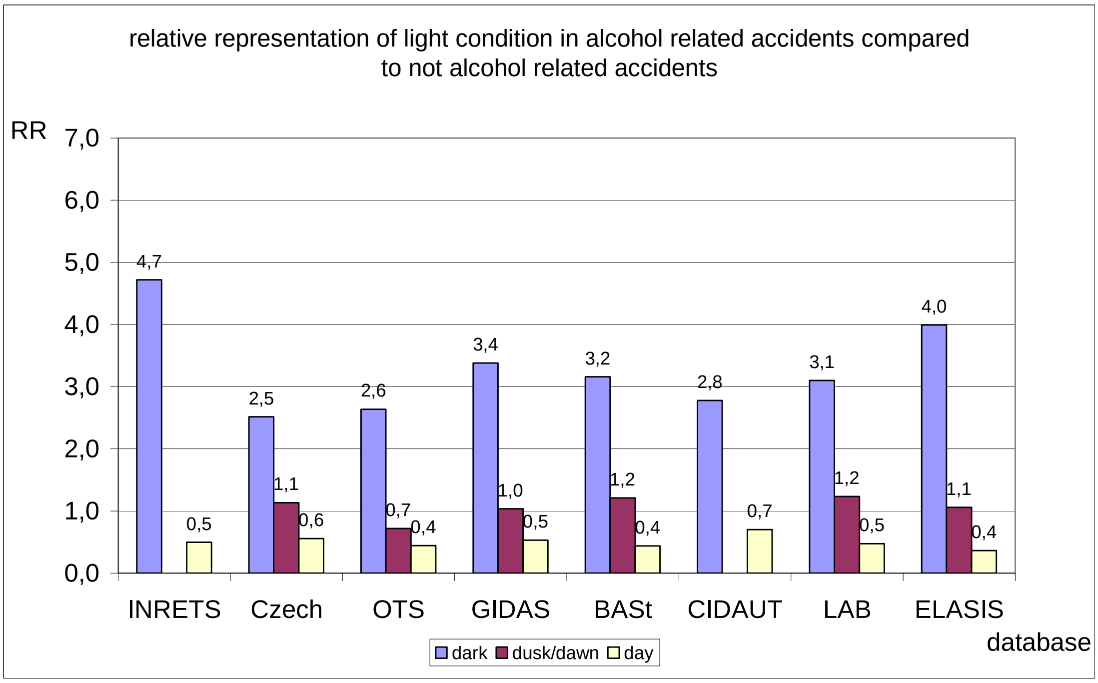
	Location	OR	95% CI lower limit	95% CI upper limit
Czech	Rural	1,07	1,03	1,21
BASt	Rural	1,15	1,13	1,46
ELASIS	Rural	1,70	1,38	3,63



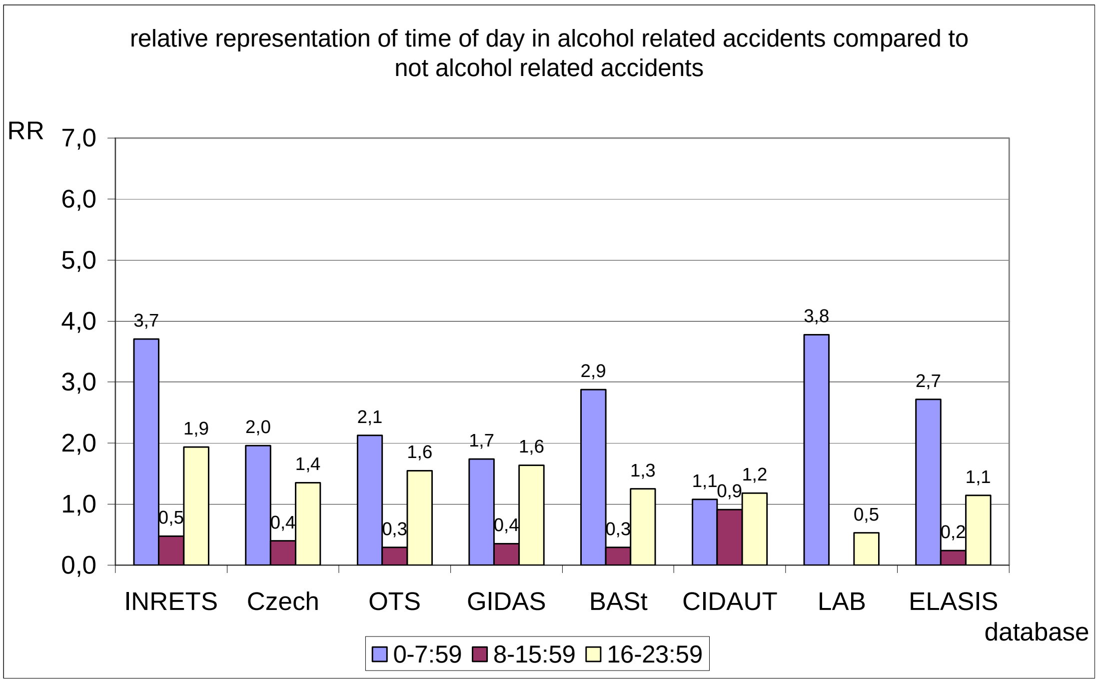
	Road type	OR	95% CI lower limit	95% CI upper limit
BASt	Autobahn, National road	0,81	0,50	0,83
Czech	Other roads	1,58	1,50	2,85
GIDAS	Country road	1,51	1,11	3,16
ELASIS	Other roads	2,19	1,73	5,31



	Speed limit	OR	95% CI lower limit	95% CI upper limit
BASt	<50	1,05	1,01	1,15



	light conditions	OR	95% CI lower limit	95% CI upper limit
Czech	dark	4,33	4,17	8,60
GIDAS	dark	5,82	4,54	12,44
LAB	dark	6,09	3,39	17,28
BASt	dark	6,48	6,38	11,51
INRETS	dark	9,9	2,8	51,0
ELASIS	dark	8,92	7,04	16,41



	time of day	OR	95% CI lower limit	95% CI upper limit
Czech	0-7:59	4,90	4,66	9,55
GIDAS	0-7:59	4,94	3,37	12,49
OTS	0-7:59	7,35	4,19	18,65
BASt	0-7:59	9,89	9,68	15,73
ELASIS	0-7:59	11,55	9,57	19,05
Czech	16-23:59	3,38	3,23	7,08
BASt	16-23:59	4,30	4,20	8,48
GIDAS	16-23:59	4,66	3,36	11,44
OTS	16-23:59	5,36	3,28	14,59
Czech	16-23:59	3,38	3,23	7,08

Summary

Method: Cross tabs with OR and 95% Confidence interval

Factor	Partner	Bivariate results from data request 3B
alcohol	INRETS	25-44 ↑↑ Dark ↑↑ 8-15:59 ↓↓
alcohol	Czech national	Male ↑ >65 ↓↓ Bicycle ↑ Other impact types ↑ hitting object (immobile) ↑ Rural ↑ Other roads ↑ Dark ↑↑ 8-15:59 ↓↓
alcohol	OTS	male↑ pedestrian↑ rollover↑ GOING AROUND BEND↑ 8-15:59 ↓↓
alcohol	GIDAS	Male ↑ Unemployed ↑↑ Pedestrian ↑ and Bicycle ↑ Other impact type↑ going straight ↑ Country road ↑ Dark ↑↑ 8-15:59 ↓↓
alcohol	BASt	male ↑ 25-44 ↑ Bicycle ↑ frontal↑ running off the road ↑ Rural ↑ Autobahn, National road ↓ <50 ↑ Dark ↑↑ 8-15:59 ↓↓
alcohol	DIANA	Overtaking ↑
alcohol	LAB	Male ↑ running off the road ↑ going straight ↑ dark ↑
alcohol	ELASIS	male ↑ Car, Van, <3.5t ↑ Other type of impact ↑ hitting object (immobile) ↑ going straight ↑ Rural ↑ Other roads ↑ dark ↑ 8-15:59 ↓

Table 7-1: associations to alcohol as found by data request 3B

Annex III Vigilance

Vigilance – data request 3A result

Descriptive

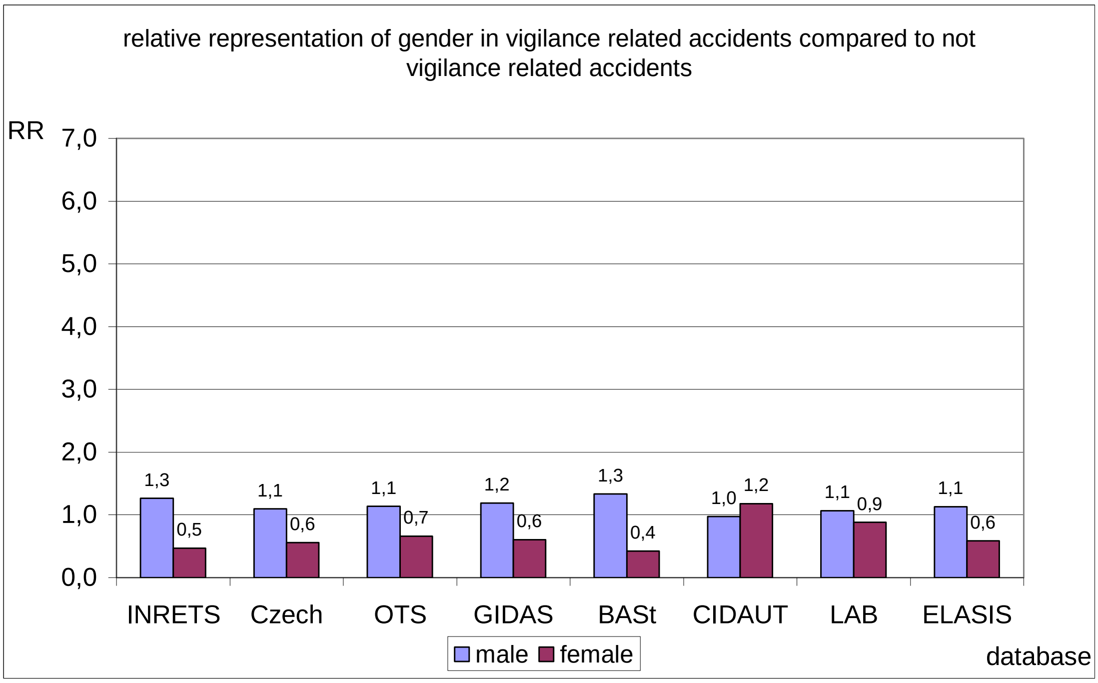
database	% of accidents in data sample	exact variable name
INRETS	9.3%	low vigilance
database	**% of accidents in data sample**	**exact variable name**
SISS ELASIS	0.1%	sleepy and tiredness for exceeding driving time
GIDAS BASt	0.6%	tiredness
BASt	0.8%	overfatigue
STATS 19	1.3%	fatigue
Czech Republic	*1.9%*	*tired, fall asleep*
CIDAUT	*2.6%*	*drowsiness or illness*
LAB	3.1%	fatigue
OTS	3.4%	Impairment through fatigue
TNO MAIDS 2000	7.1%	fatigue
TNO MAIDS 2001	8.0%	fatigue
TNO EACS	15.0%	Driver tired
DIANA	17.4%	Fatigue, drowsiness because of tiredness

Relative representation in database

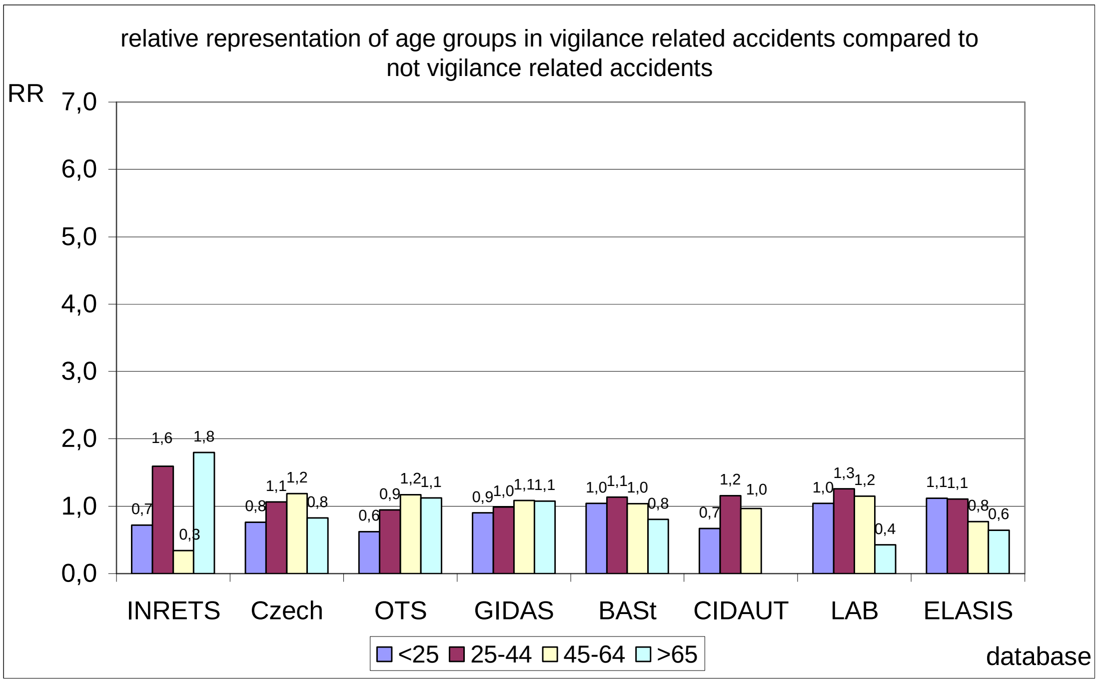
database	Contributory factor reported in accident	RR	
CIDAUT_in-depth	5.1. Tiredness.	6,2	RR
Monash_Australia_in-depth	Asleep/fatigue - can apply when there is no direct evidence but facts suggest this to be likely, e.g., prolonged driving (this is the only instance where road user impairment can be coded in the absence of hard evidence)	4,21	fatal RR
LAB_in-depth	Fatigue	2,03	fatal RR
INRETS_in-depth	- Low vigilance (in its physiological acceptation: level of arousal)	1,41	RR
LAB_in-depth	Fatigue	1,21	RR
Czech_national	tired, fall asleep	1,13	fatal RR

Vigilance and explanatory variables

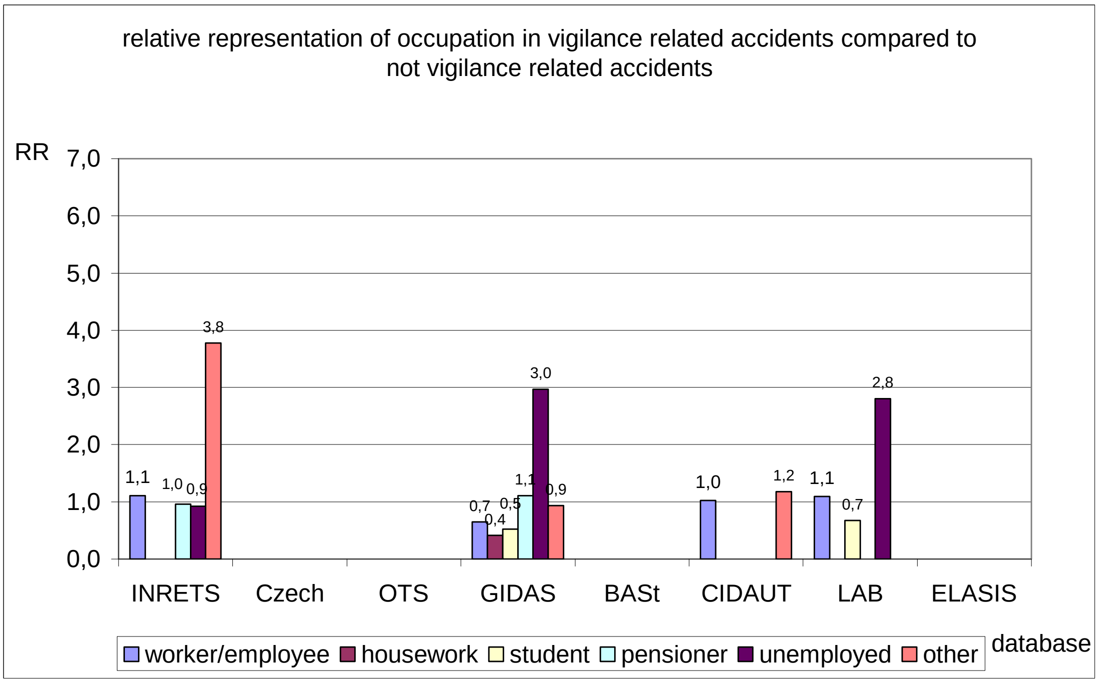
Data request 3B: results of preparation and Relative Risks in Comparison of the databases (graph) and calculation of OR with 95% Confidence intervals (only significant (level 0.05) results are presented) (table).



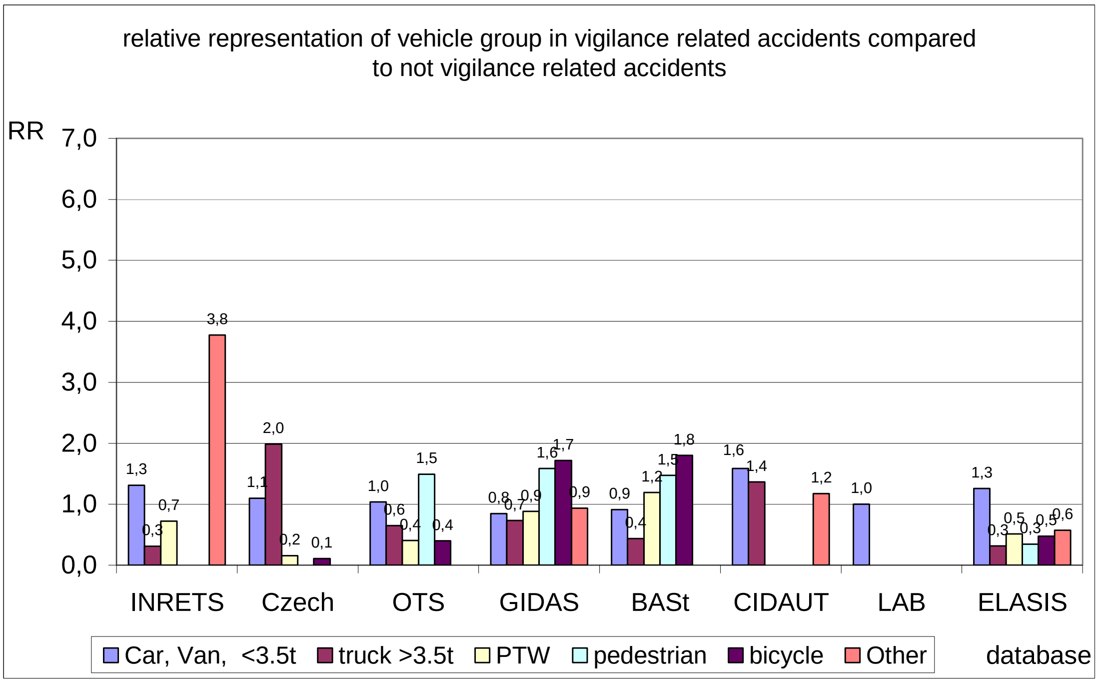
	Gender	OR	95% CI lower limit	95% CI upper limit
BASt	male	3,13	3,06	6,49
Czech	male	1,97	1,66	4,42
GIDAS	male	1,96	1,51	4,70
OTS	male	1,72	1,18	4,26
ELASIS	male	1,93	1,68	4,18



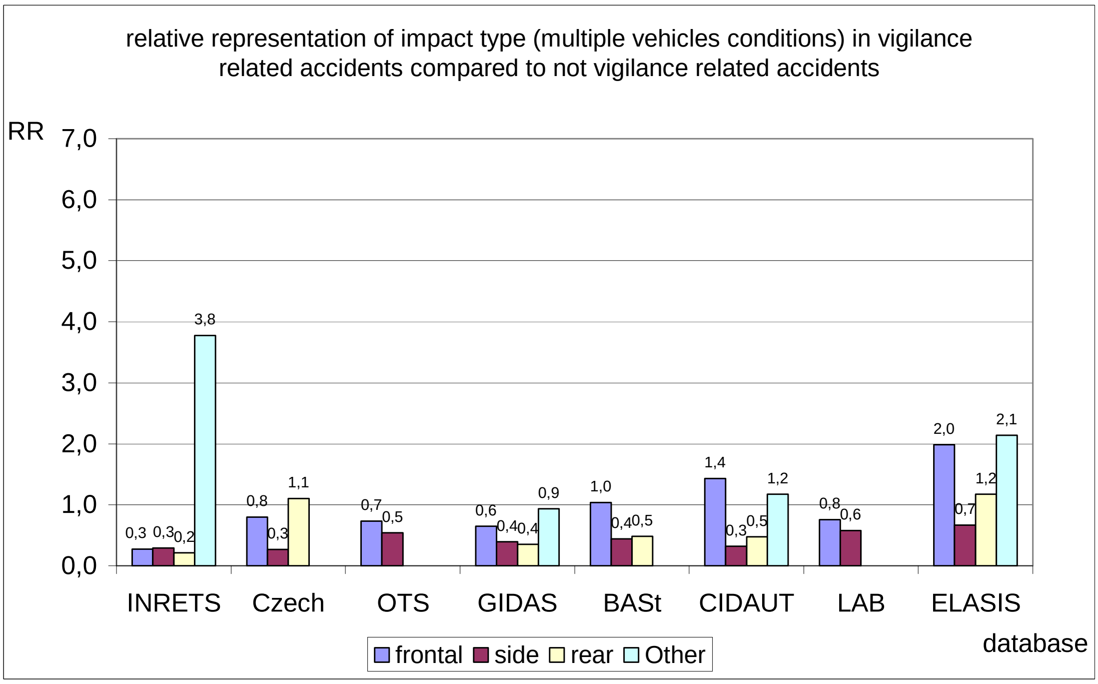
	Age group	OR	95% CI lower limit	95% CI upper limit
BASt	25-44	1,23	1,21	1,71
Czech ELASIS	25-44 25-44	1,13 1,26	1,01 1,14	1,43 1,87



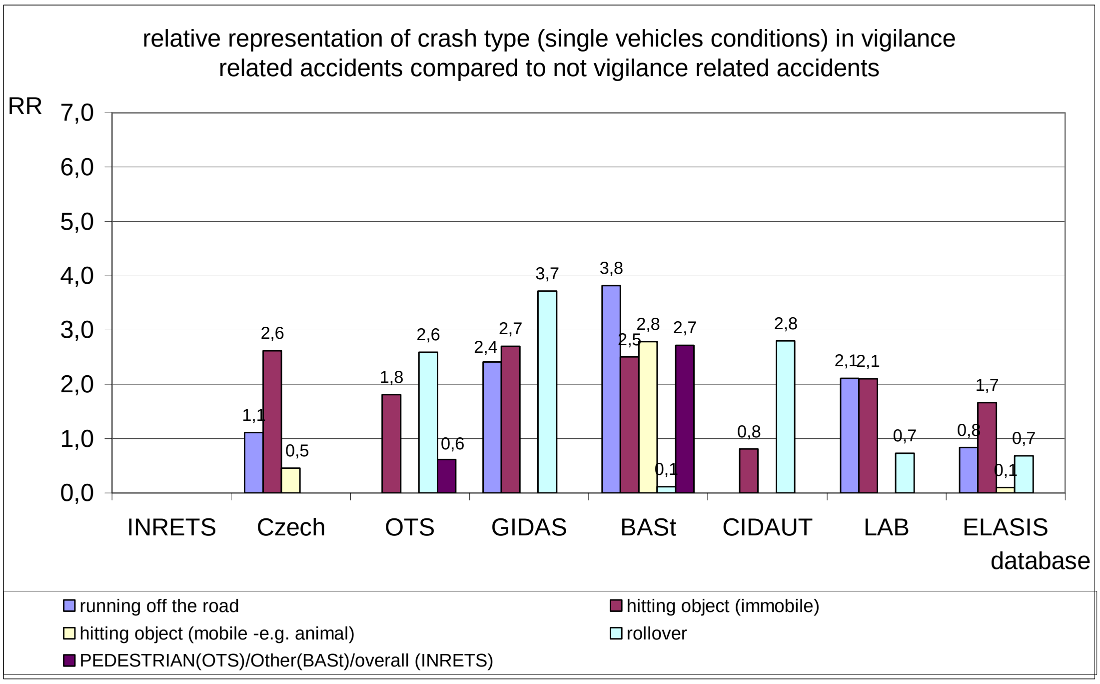
	occupation	OR	95% CI lower limit	95% CI upper limit
GIDAS	unemployed	4,23	2,91	11,16



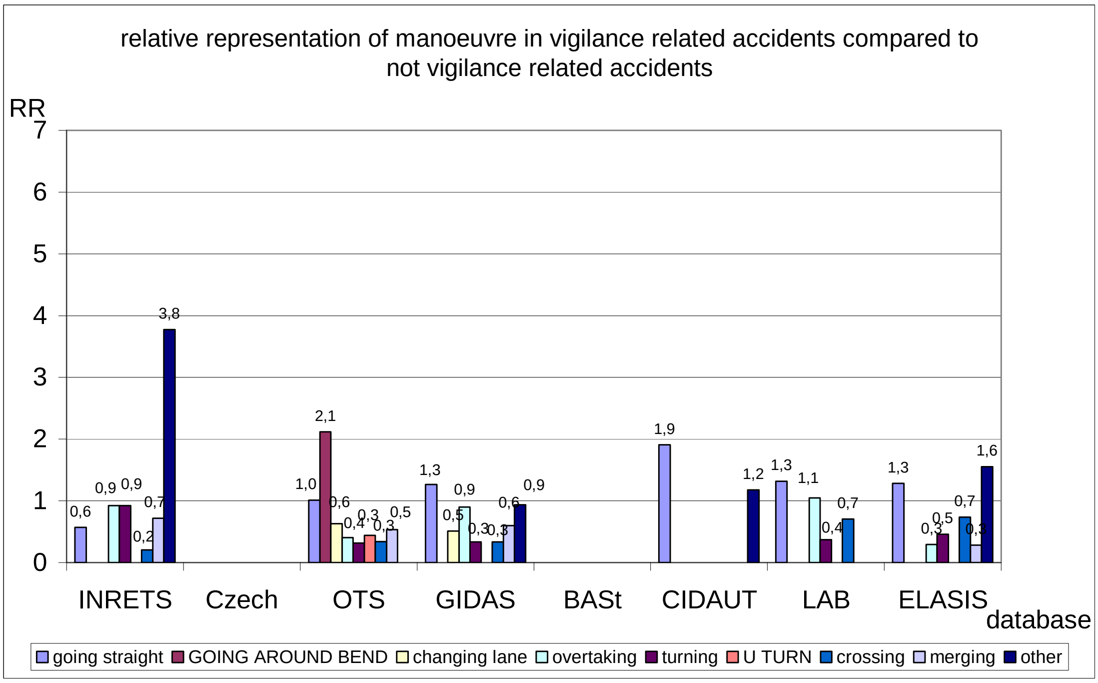
	Vehicle group	OR	95% CI lower limit	95% CI upper limit
INRETS	Car, Van, <3.5t	3,50	1,00	40,82
Czech	truck >3.5t	2,23	1,94	5,00
BASt	bicycle	1,97	1,94	3,93
GIDAS	bicycle	1,92	1,48	4,55
ELASIS	Car, Van, <3.5t	2,61	2,30	5,90



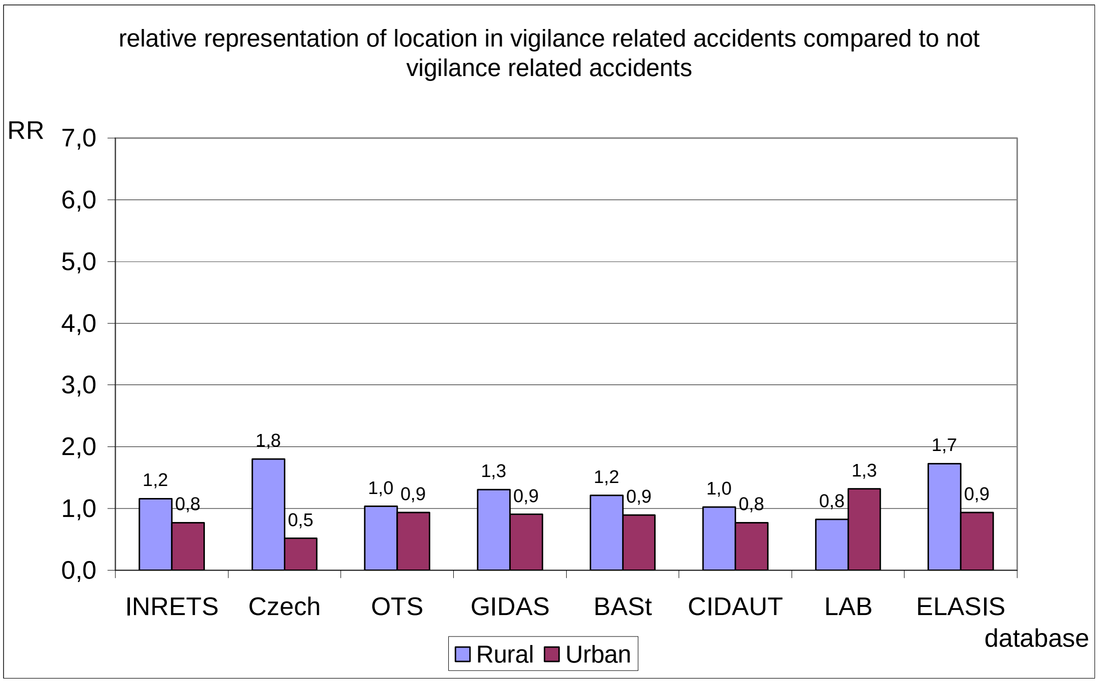
	impact type multiple vehicle collision	OR	95% CI lower limit	95% CI upper limit
Czech	Other	2,38	2,12	5,30
BASt	frontal	2,14	2,08	4,37
ELASIS	Other	2,48	2,04	5,92



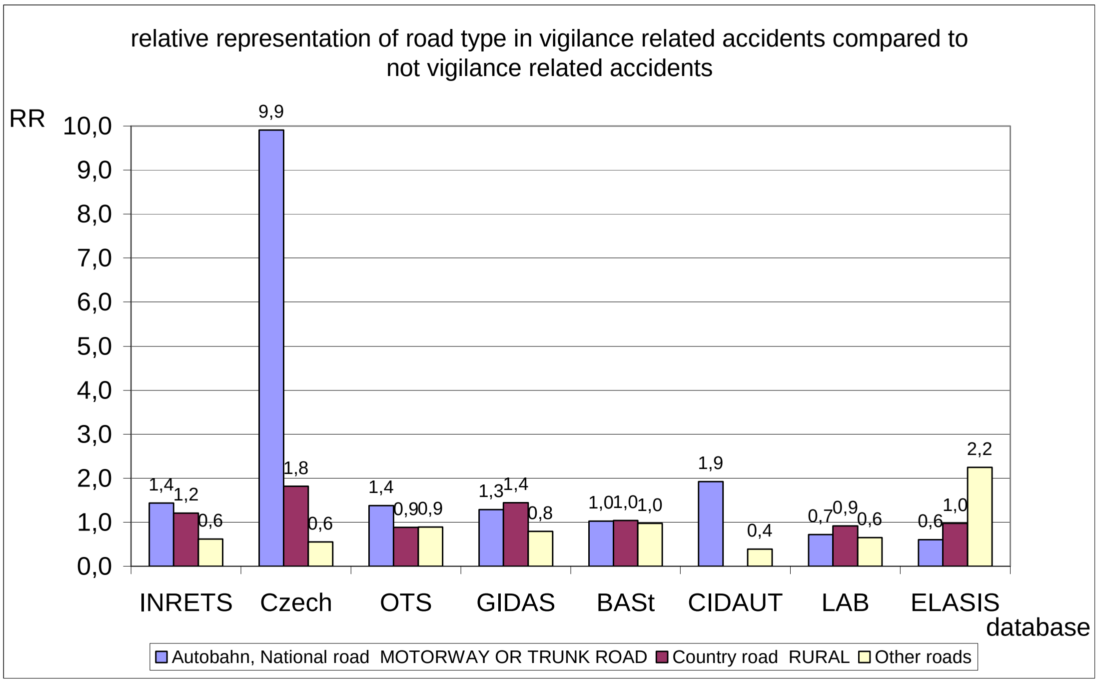
	crash type single vehicle	OR	95% CI lower limit	95% CI upper limit
Czech	hitting object (immobile)	4,68	4,25	9,55
LAB	running off the road	2,88	1,64	10,21
BASt	running off the road	1,48	1,45	2,52
ELASIS	hitting object (immobile)	2,16	1,72	5,20



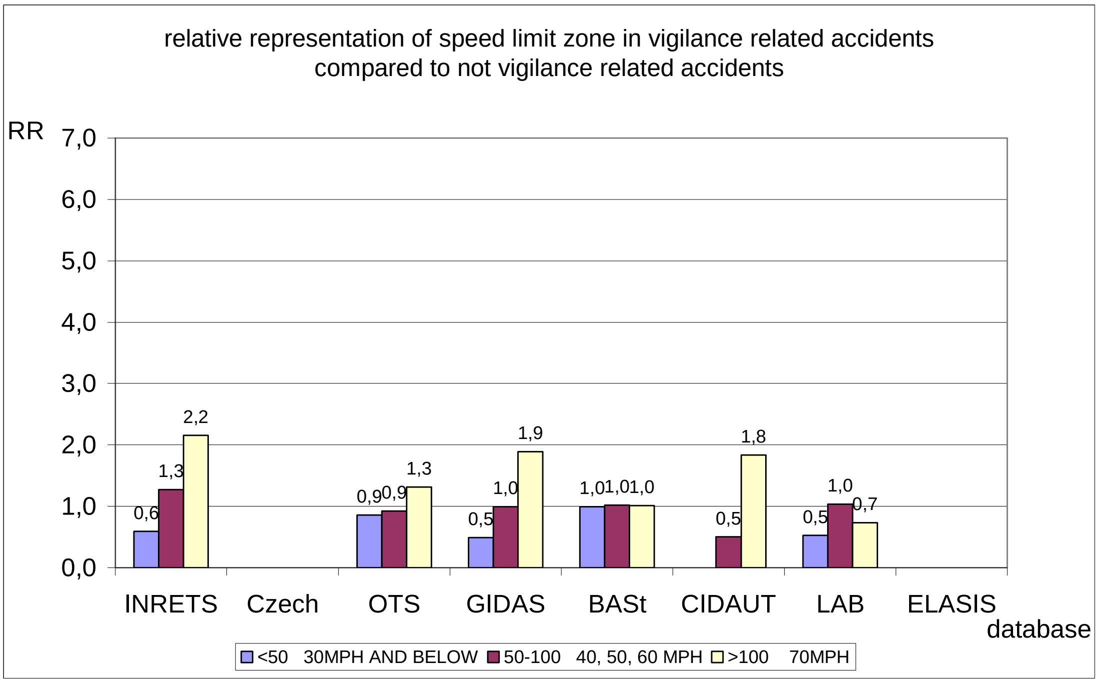
	manoeuvre	OR	95% CI lower limit	95% CI upper limit
DIANA	going straight	12,76	2,05	146,21
OTS	GOING AROUND BEND	2,96	2,13	8,05
GIDAS	going straight	2,24	1,75	5,53
LAB	going straight	1,92	1,28	5,24
ELASIS	going straight	1,50	1,35	2,72



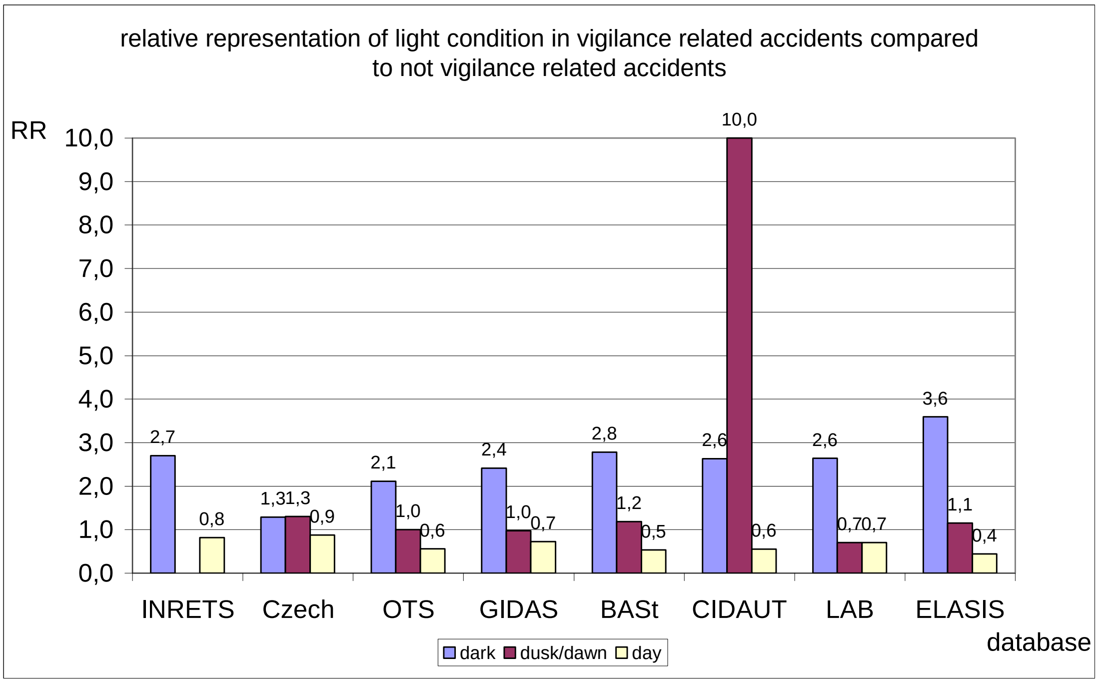
	Location	OR	95% CI lower limit	95% CI upper limit
Czech	Rural	3,55	3,19	7,74
GIDAS	Rural	1,44	1,14	2,69
BASt	Rural	1,35	1,33	2,10
LAB	Rural	0,62	0,90	0,22
ELASIS	Rural	1,85	1,53	4,06



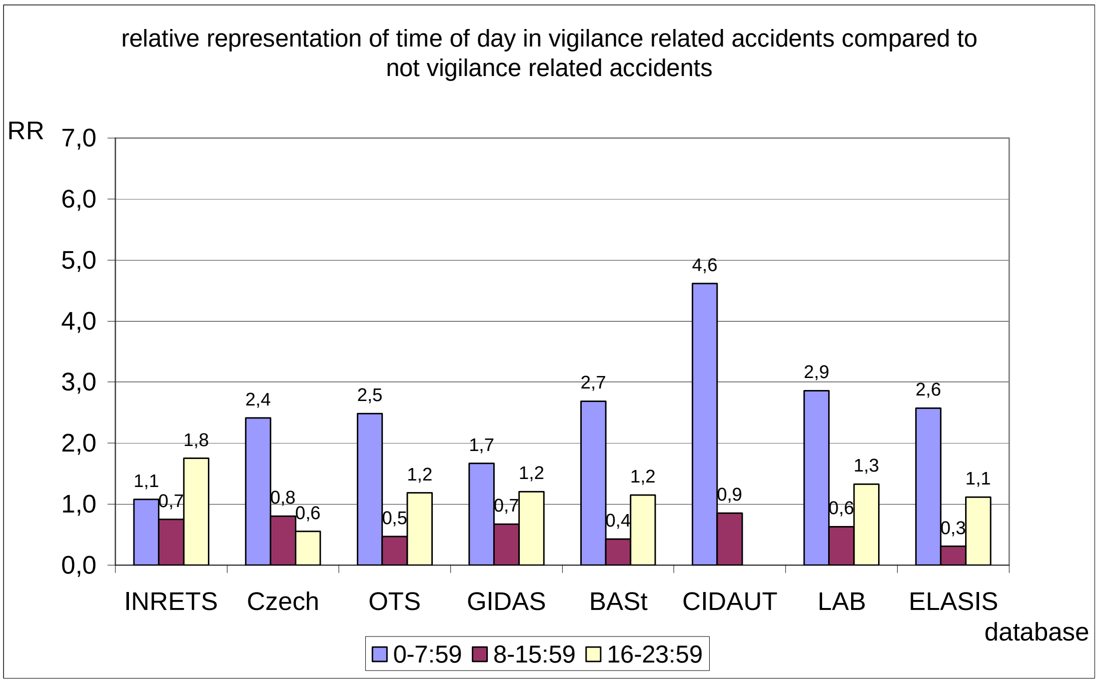
	Road type	OR	95% CI lower limit	95% CI upper limit
DIANA	Autobahn, National road	5,00	1,24	63,11
Czech	Country road	2,42	2,18	5,36
GIDAS	Country road	1,60	1,25	3,34
OTS	Autobahn, National road MOTORWAY OR TRUNK ROAD	1,55	1,07	3,49
BASt	Country road	1,06	1,04	1,17
ELASIS	Other roads	2,39	1,94	5,76



	Speed limit	OR	95% CI lower limit	95% CI upper limit
GIDAS	>100	2,06	1,49	5,29
OTS	>100 70MPH	1,48	1,01	3,20
BASt	50-100	1,02	1,00	1,07



	light condition	OR	95% CI lower limit	95% CI upper limit
BASt	dark	4,82	4,75	9,21
LAB	dark	3,78	2,49	10,78
OTS	dark	3,54	2,65	9,00
INRETS	dark	3,47	1,10	31,77
GIDAS	dark	3,2	2,6	7,8
Czech	dark	1,44	1,29	2,51
ELASIS	dark	6,84	5,52	13,54



	time of day	OR	95% CI lower limit	95% CI upper limit
BASt	0-7:59	6,29	6,17	11,27
DIANA	0-7:59	5,41	1,44	54,09
LAB	0-7:59	4,53	2,57	14,34
Czech	0-7:59	3,07	2,73	6,85
GIDAS	0-7:59	2,48	1,87	6,44
OTS	0-7:59	1,48	1,01	3,20
ELASIS	0-7:59	8,24	6,98	14,90
BASt	16-23:59	2,69	2,64	5,61
OTS	16-23:59	2,51	1,76	6,98
LAB	16-23:59	2,11	1,36	6,19
GIDAS	16-23:59	1,79	1,41	4,03
Czech	16-23:59	0,68	0,79	0,27
ELASIS	16-23:59	3,57	2,96	8,28

Summary - Method: Cross tabs with OR and 95% Confidence interval

Factor	Partner	Results from data request 3B
vigilance	INRETS	Car, Van, <3.5t ↑ dark ↑
vigilance	Czech national	Male ↑ 25-44 ↑ truck >3.5t ↑ Other impact types ↑ hitting object (immobile) ↑ Rural ↑ Country roads ↑ Dark ↑ 0-7:59 ↑
vigilance	OTS	male↑ GOING AROUND BEND ↑ Autobahn, National road MOTORWAY OR TRUNK ROAD ↑ >100 70MPH ↑ Dark ↑ 16-23:59 ↑
vigilance	GIDAS	Male ↑ Unemployed ↑ Bicycle ↑ going straight ↑ Rural ↑ Country road ↑ >100 ↑ Dark ↑ 0-7:59 ↑
vigilance	BASt	male ↑ 25-44 ↑ Bicycle ↑ frontal↑ running off the road ↑ Rural ↑ Country road ↑ 50-100↑ Dark ↑ 0-7:59 ↑
vigilance	DIANA	going straight ↑ Autobahn, National road ↑ 0-7:59 ↑
vigilance	LAB	running off the road ↑ going straight ↑ Rural ↑ dark ↑ 0-7:59 ↑
vigilance	ELASIS	male↑ 25-44 ↑ Car, Van, <3.5t ↑ Other ↑ hitting object (immobile) ↑ going straight ↑ Rural ↑ Other roads ↑ dark ↑ 0-7:59 ↑ 16-23:59 ↑

Table 7-2: HUMAN Trip-related factor: vigilance

Annex IV Experience

Experience – data request 3A result

Descriptive

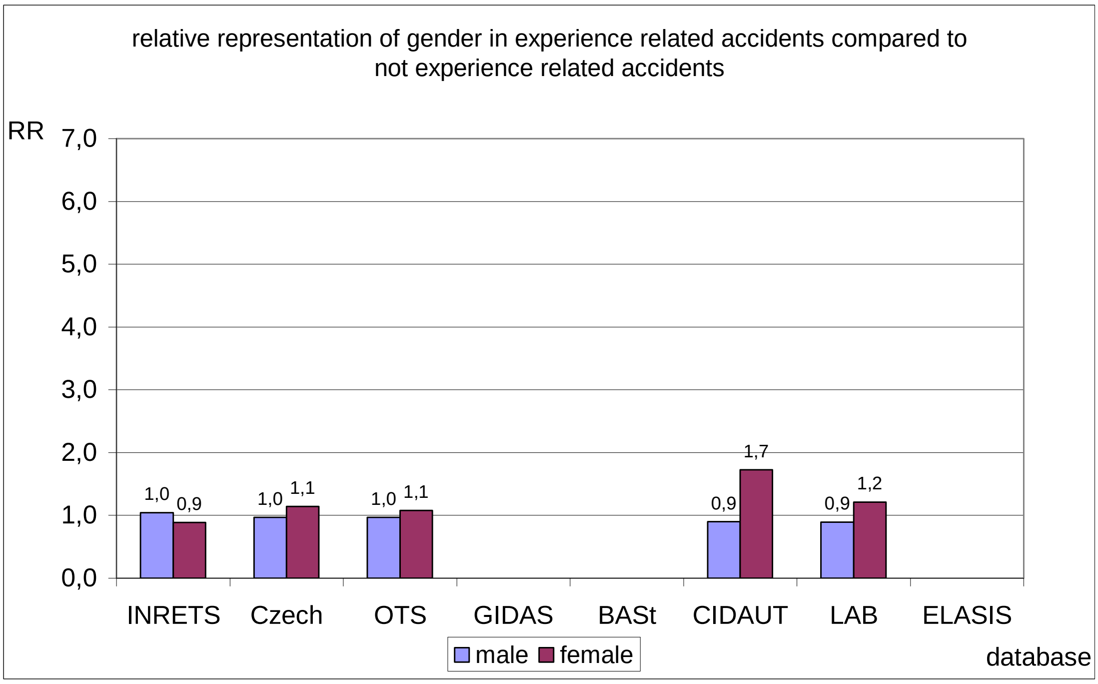
database	% of accidents in data sample	exact variable name
DIANA	0%	lack of experience
IDIADA ETAC	1.3%	driving inexperience
CIDAUT	3.9%	driver's lack of experience
TNO MAIDS 2000	4.4%	Low experience driving with passengers or luggage
OTS	4.5%	inexperience of driving
INRETS	4.7%	low experience of driving (e.g novice driver) and sporadic driving (e.g. elderly driver)
STATS 19	5.1%	Learner/inexperienced driver
TNO MAIDS 2001	5.3%	Low experience driving with passengers or luggage
LAB	6.6%	poor experience
TNO Trucks	12.0%	Driver inexperience
database	**% of accidents in data sample**	**exact variable name**
DIANA	0%	vehicle infamiliarity
IDIADA ETAC	0%	vehicle infamiliarity
STATS 19	0.9%	unfamiliar with model of vehicle
INRETS	2.3%	low experience of the vehicle handling
LAB	2.7%	poor experience of vehicle
OTS	4.3%	inexperience of vehicle
TNO MAIDS 2000	5.3%	Vehicle unfamiliarity

Relative representation in database

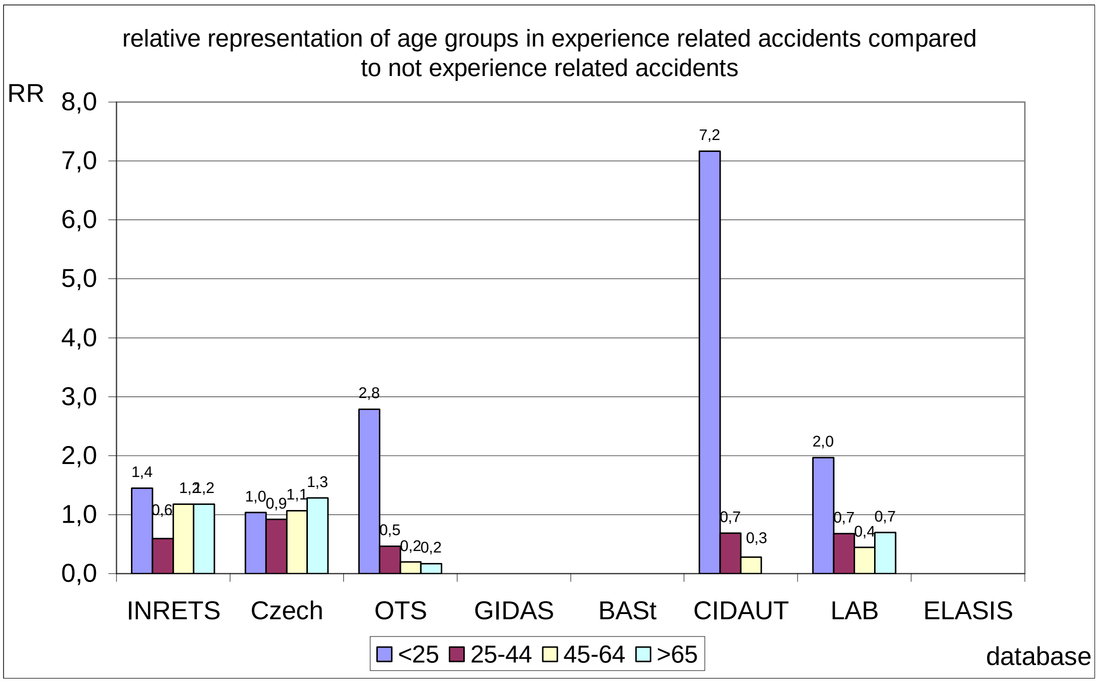
database	Contributory factor reported in accident	RR	
LAB_in-depth	Poor experience	4,34	fatal RR
LAB_in-depth	Poor experience	2,6	RR
LAB_in-depth	Poor experience of accident site	2,17	fatal RR
LAB_in-depth	Poor experience of vehicle	1,75	fatal RR
Stats_GB_national	Learner/Inexperienced driver	1,7	RR
Stats_GB_national	Learner/Inexperienced driver	1,62	fatal RR
Monash_Australia_in-depth	Learner or inexperienced driver unable to cope - only if mentioned by the coroner or indicated in other definitive way; refers to the situation where a learner or inexperienced driver is overwhelmed by the situation and is unable to act appropriately, e.g., is unable to find/use the brakes in time; an unexpected situation has to occur for this code to be used, e.g., animal running onto carriageway	1,44	fatal RR
INRETS_in-depth	- Site not known	1,4	RR
TUG_Austria_in-depth	Experience	1,34	fatal RR
LAB_in-depth	Poor experience of accident site	1,3	RR
MAIDS_NL_2000_in-depth	Vehicle unfamiliarity	1,23	fatal RR

Experience and explanatory variables

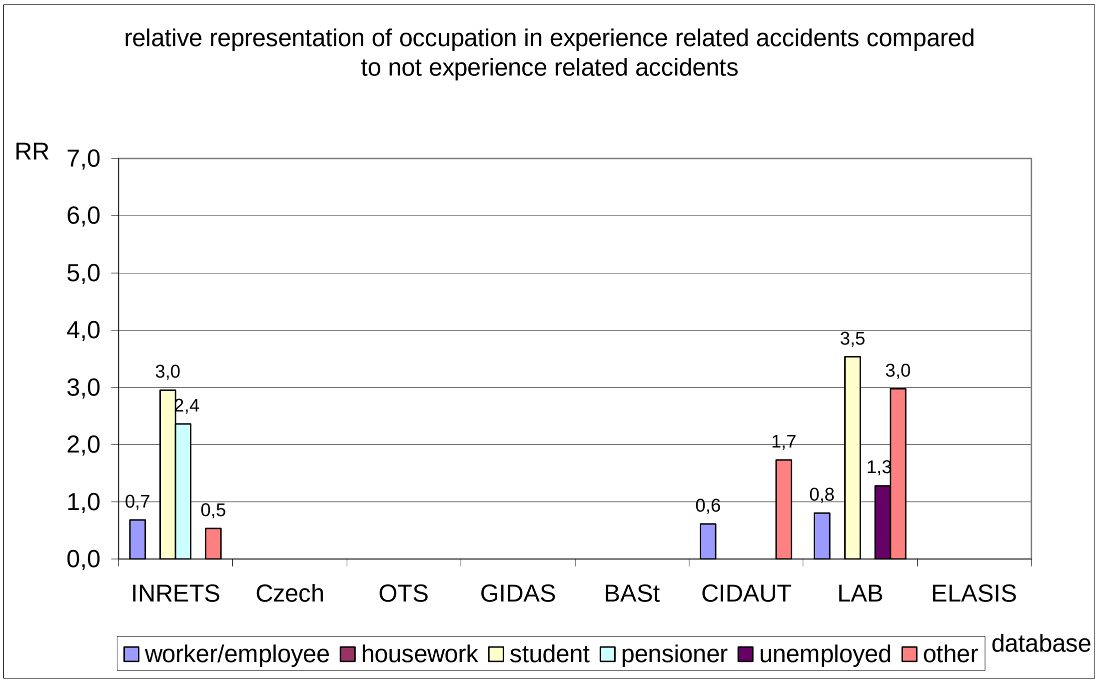
Data request 3B: results of preparation and Relative Risks in Comparison of the databases (graph) and calculation of OR with 95% Confidence intervals (only significant (level 0.05) results are presented) (table).



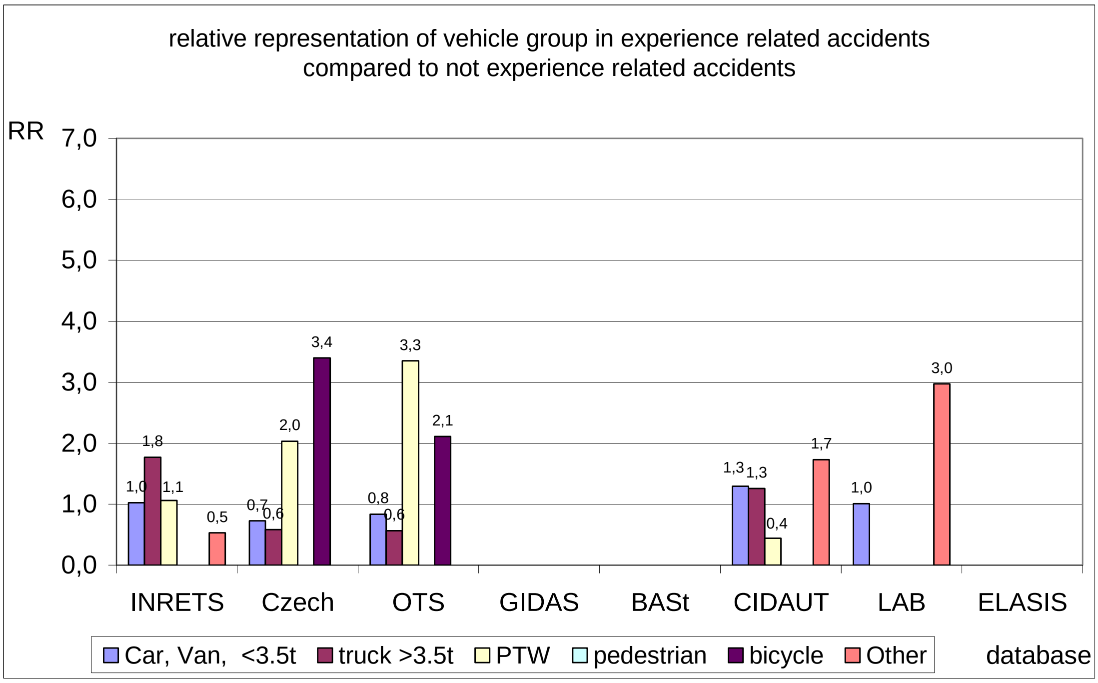
	Gender	OR	95% CI lower limit	95% CI upper limit
Czech	male	0,85	0,90	0,59



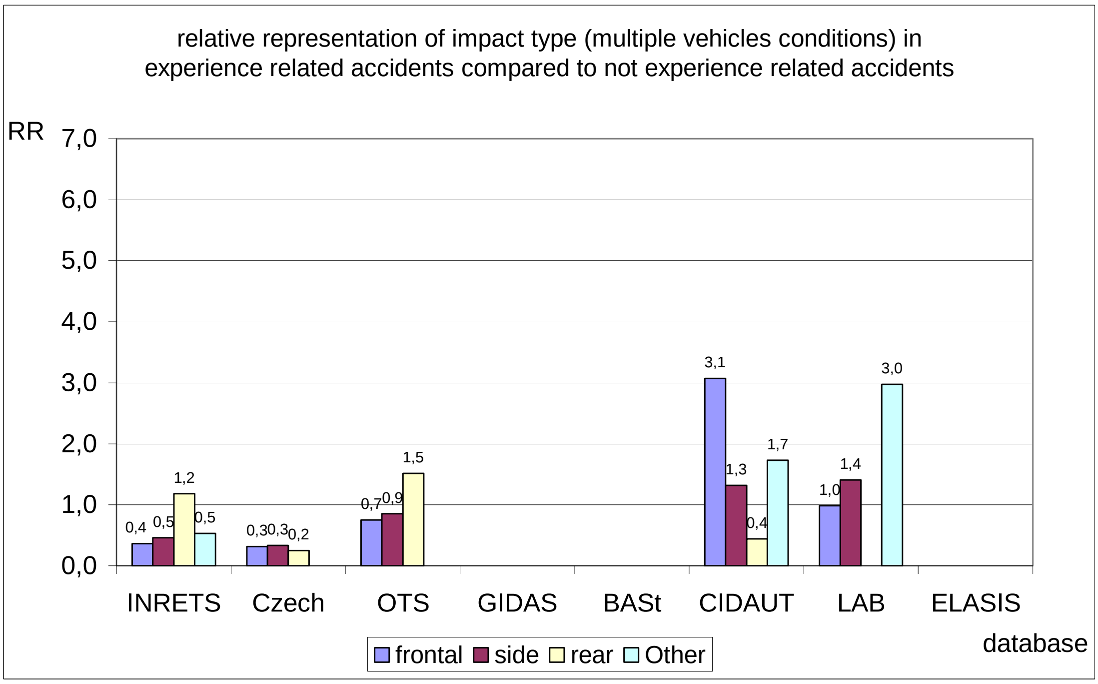
	Age group	OR	95% CI lower limit	95% CI upper limit
Czech	25-44	0,86	0,90	0,62
OTS	<25	7,79	4,98	17,47
DIANA	<25	13,33	4,21	44,53
LAB	<25	3,136	1,92	10,07



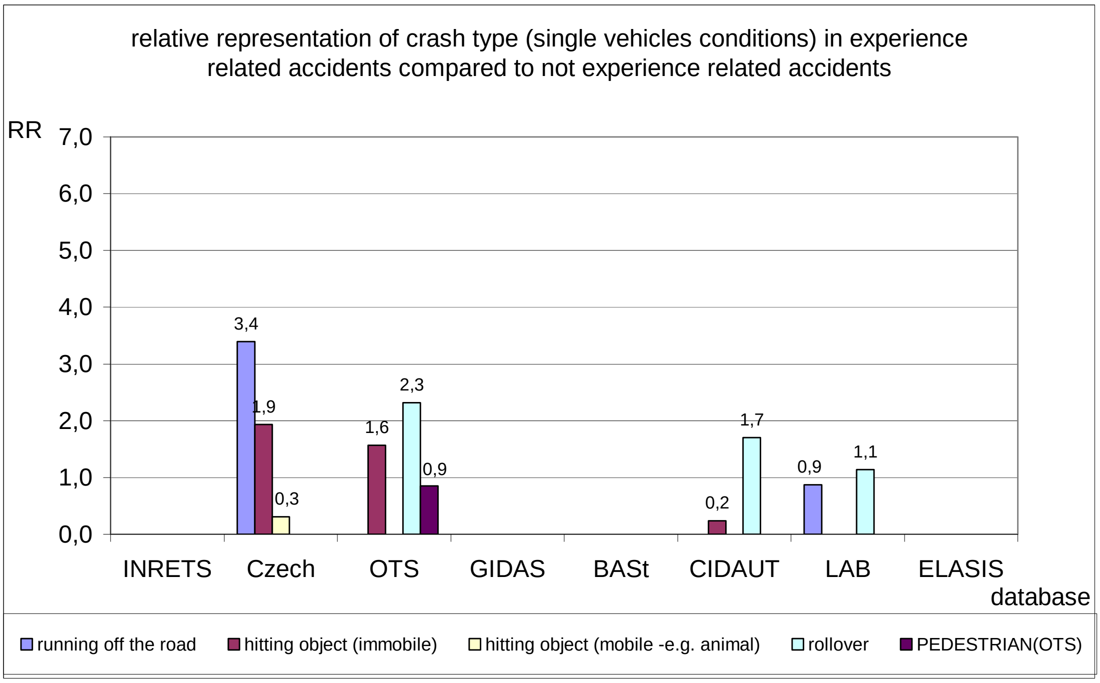
	occupation	OR	95% CI lower limit	95% CI upper limit
DIANA	worker/employee	0,31	0,81	0,02
LAB	worker/employee	0,28	0,48	0,00



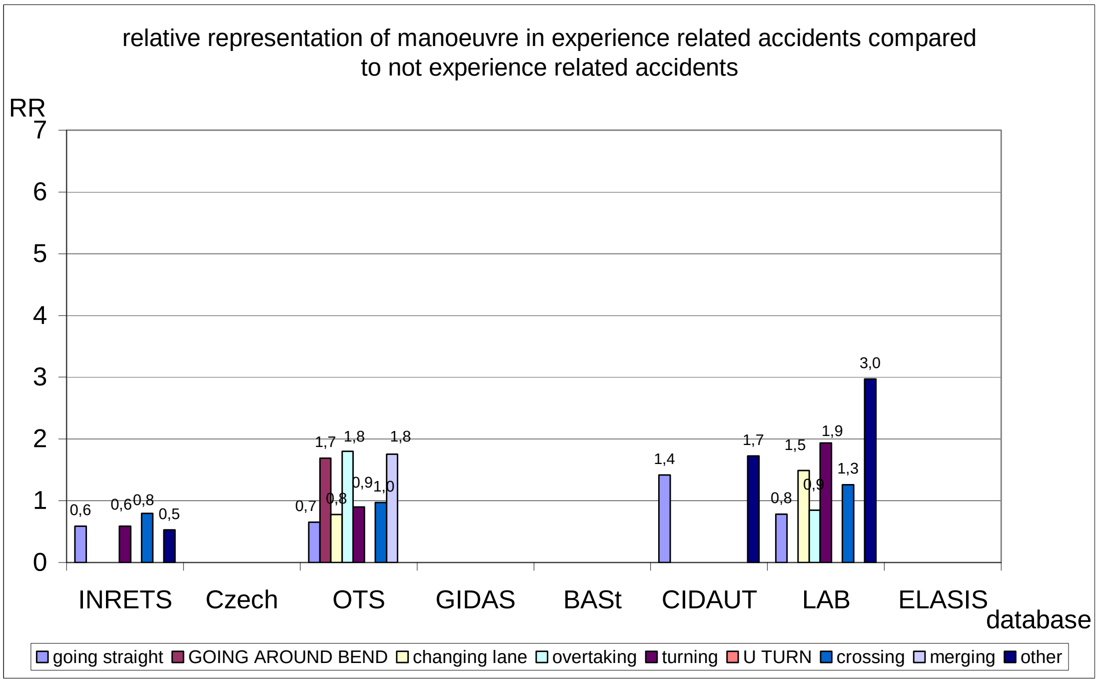
	Vehicle group	OR	95% CI lower limit	95% CI upper limit
Czech	bicycle	4,32	4,10	8,69
OTS	PTW	4,29	2,68	12,43



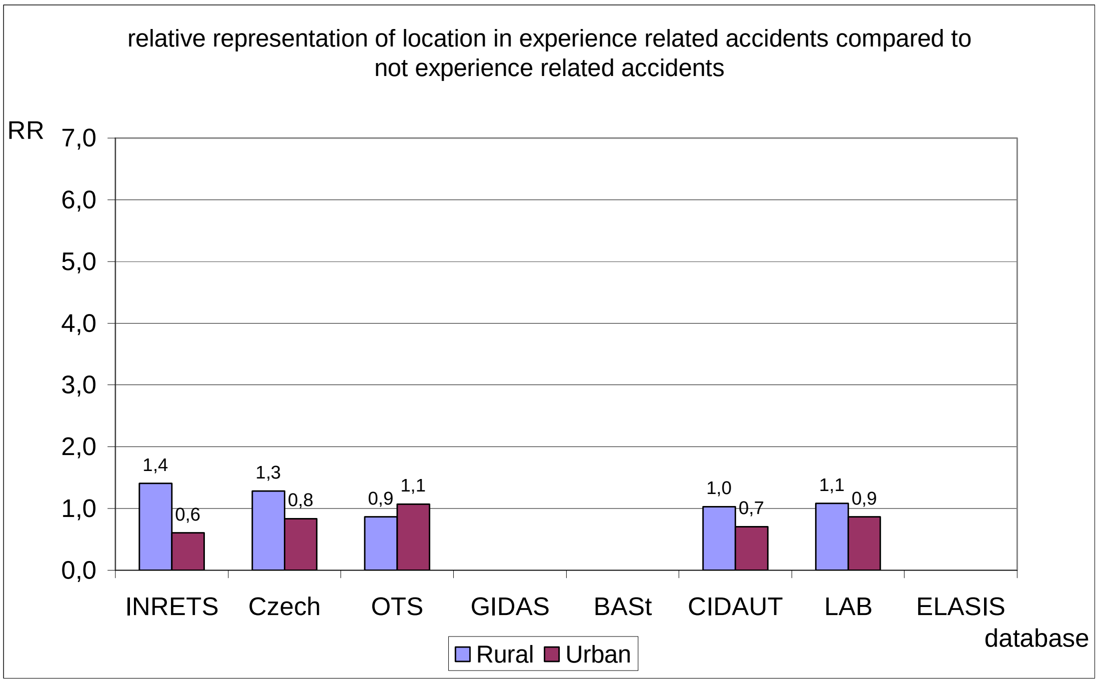
	impact type multiple vehicle collision	OR	95% CI lower limit	95% CI upper limit
Czech	Other	5,46	5,16	10,41



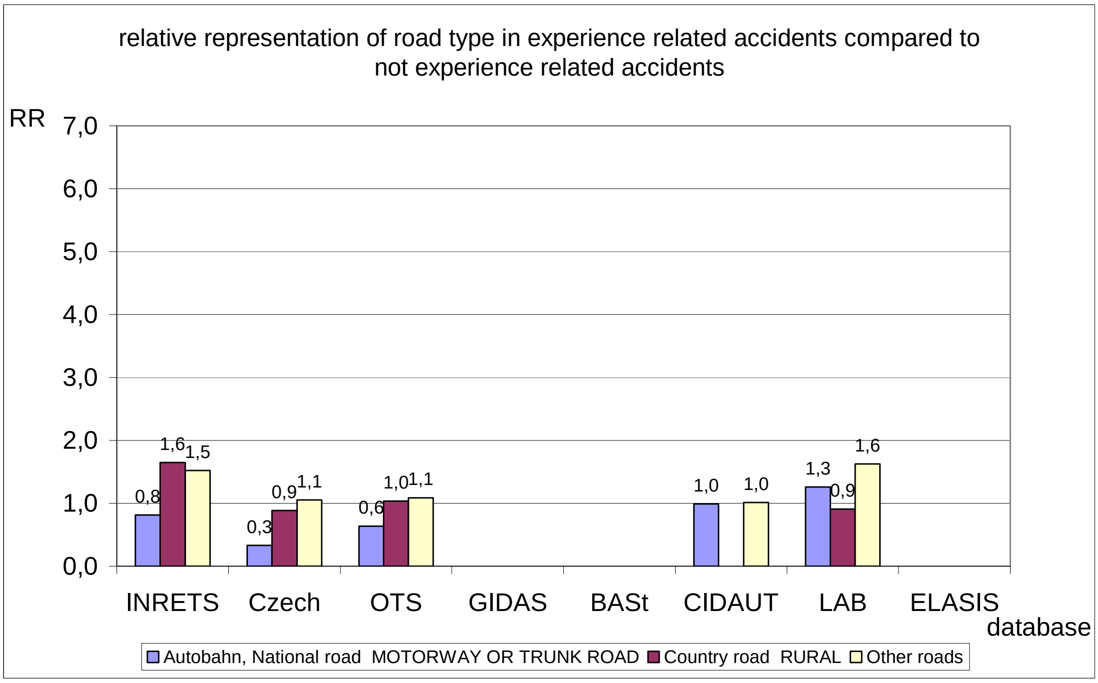
	crash type single vehicle	OR	95% CI lower limit	95% CI upper limit
Czech	running off the road	5,07	4,84	9,78



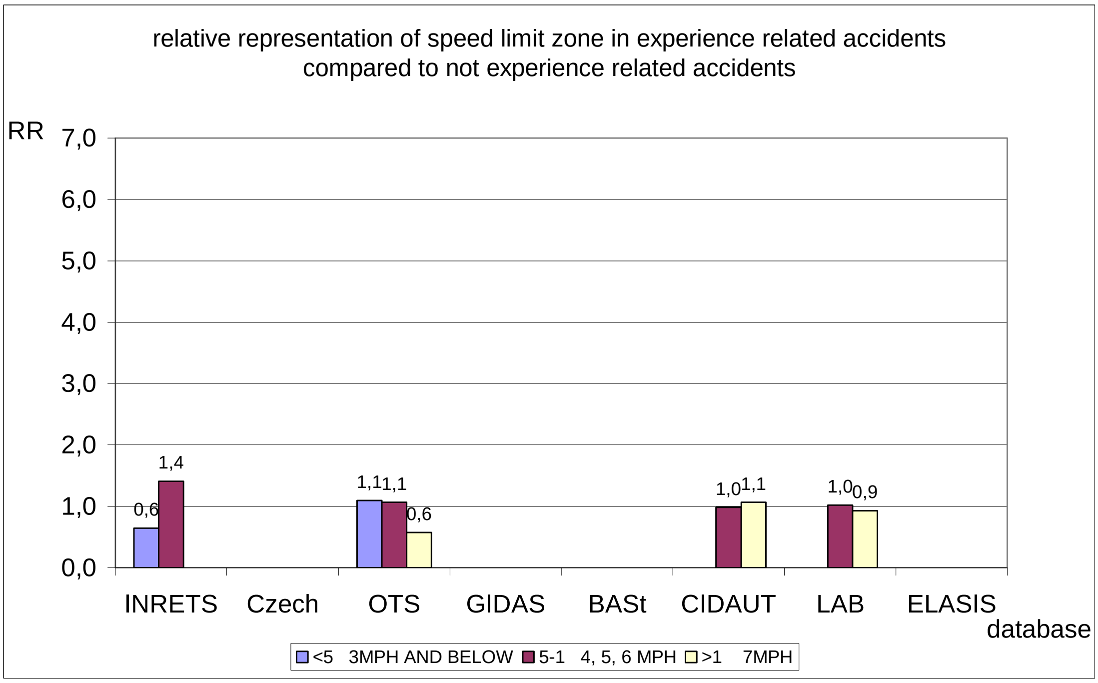
	manoeuvre	OR	95% CI lower limit	95% CI upper limit
OTS	GOING AROUND BEND	1,83	1,13	5,24
LAB	turning	2,10	1,04	8,51



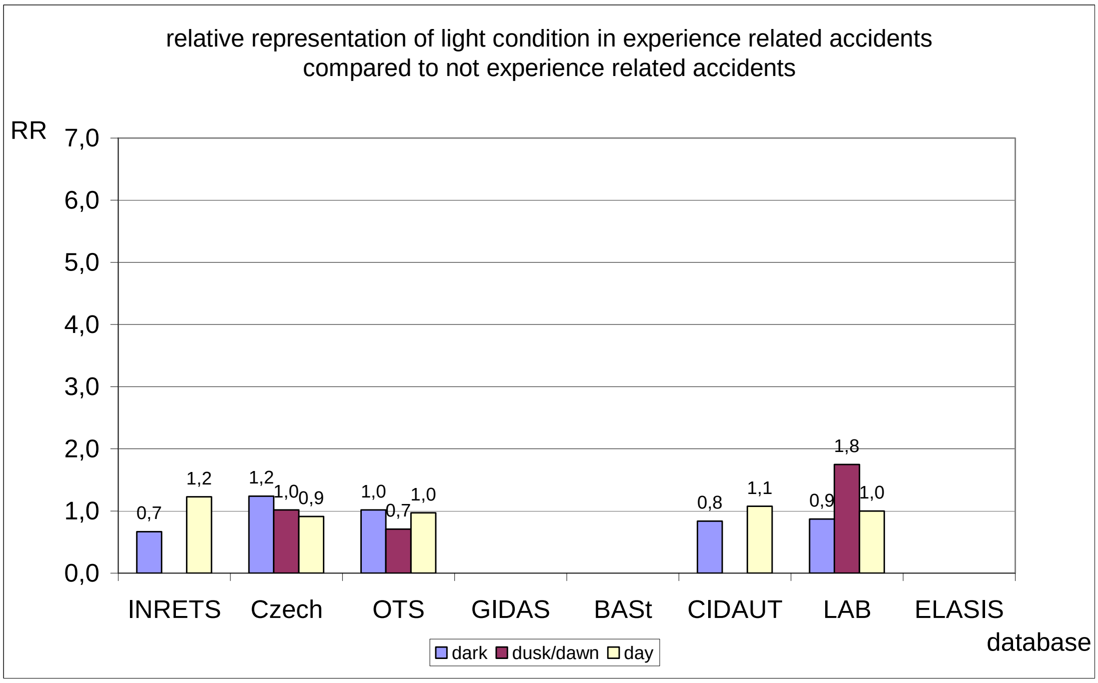
	Location	OR	95% CI lower limit	95% CI upper limit
Czech	Rural	1,54	1,47	2,74



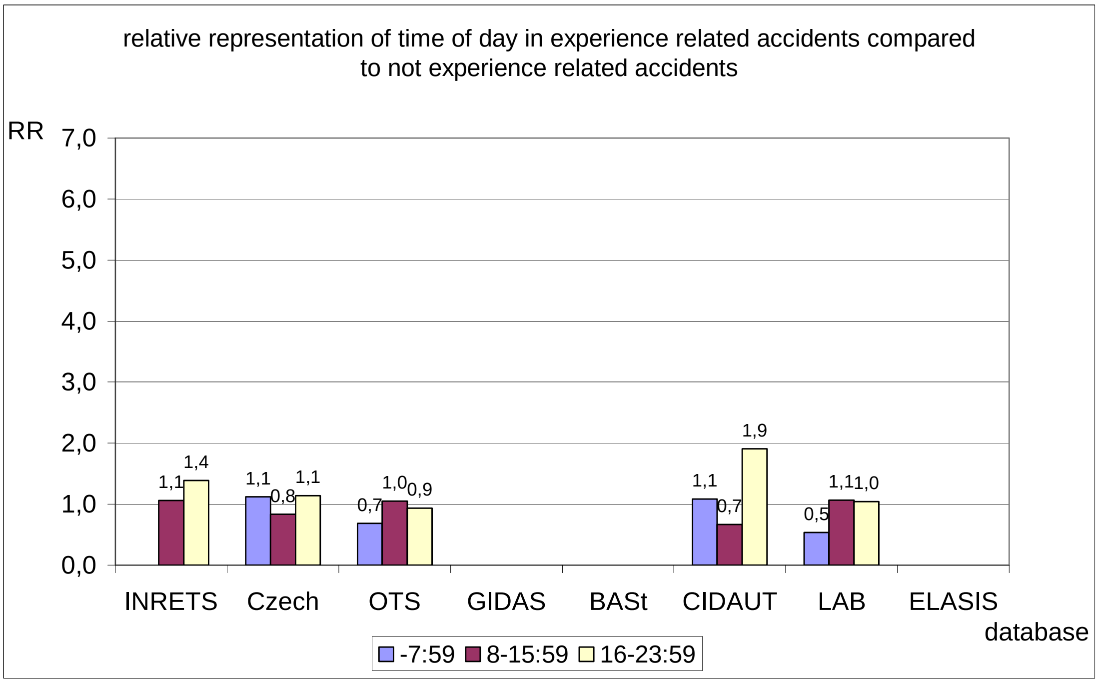
	Road type	OR	95% CI lower limit	95% CI upper limit
INRETS	Country road	6,23	1,51	66,55
Czech	Other roads	1,25	1,18	1,80



	Speed limit zone	OR	95% CI lower limit	95% CI upper limit



	light conditions	OR	95% CI lower limit	95% CI upper limit
Czech	dark	1,35	1,29	2,15



	time of day	OR	95% CI lower limit	95% CI upper limit
Czech	0-7:59	1,34	1,26	2,12
Czech	16-23:59	1,37	1,30	2,19

Summary Method: Cross tabs with OR and 95% Confidence interval

Factor	Partner	Results from data request 3B
experience	INRETS	Country road ↑
experience	Czech national	Male ↓ 25-44 ↓ Bicycle ↑ Other impact types ↑ running off the road ↑ Rural ↑ Other roads ↑ Dark ↑ 8-15:59 ↓
experience	OTS	<25 ↑ PTW ↑ GOING AROUND BEND ↑
experience	DIANA	<25 ↑ worker/employee ↓
experience	LAB	<25 ↑ worker/employee ↓ turning ↑

Table 7-3: HUMAN Trip-related factor: experience

Annex V Vehicle condition

Vehicle condition – data request 3A result

Descriptive

database	% of accidents in data sample	exact variable name
DIANA	0%	steering
GIDAS BASt	0%	defects steering
IDIADA ETAC	0%	steering system and suspension problems
Czech Republic	<0.1%	wheel or spring suspension fracture
SISS ELASIS	<0.1%	steering misuse?
BASt	0.1%	steering mechanism
IDIADA-SCT	0.1%	steering defect
STATS 19	0.2%	defective steering/suspension

database	% of accidents in data sample	exact variable name
IDIADA ETAC	0%	brake system
DIANA	0%	Brakes
IDIADA-SCT	<0.1%	brakes defect
Czech Republic	0.1%	operation brake failure
SISS ELASIS	0.1%	braking misuse?
GIDAS BASt	0.2%	defects brakes
BASt	0.3%	technical or maintenance faults: brakes
STATS 19	0.6%	defective brakes
OTS	0.9%	defective brakes

database	% of accidents in data sample	exact variable name
GIDAS BASt	0.2%	defects tyres
IDIADA-SCT	0.3%	old tyres
IDIADA ETAC	0.5%	tyres and wheels
BASt	0.6%	technical or maintenance faults: tyres
OTS	0.7%	Tyre worn or insufficient tread
TNO MAIDS 2000	0.9%	tyre: gross under inflation
STATS 19	0.8%	defective tyres
TNO MAIDS 2001	1.3%	tyre: gross under inflation
OTS	1.6%	Tyre pressure wrong
INRETS	7.0%	problem in tyre pressure and cold tyres
DIANA	8.7%	Vehicle state - tyres

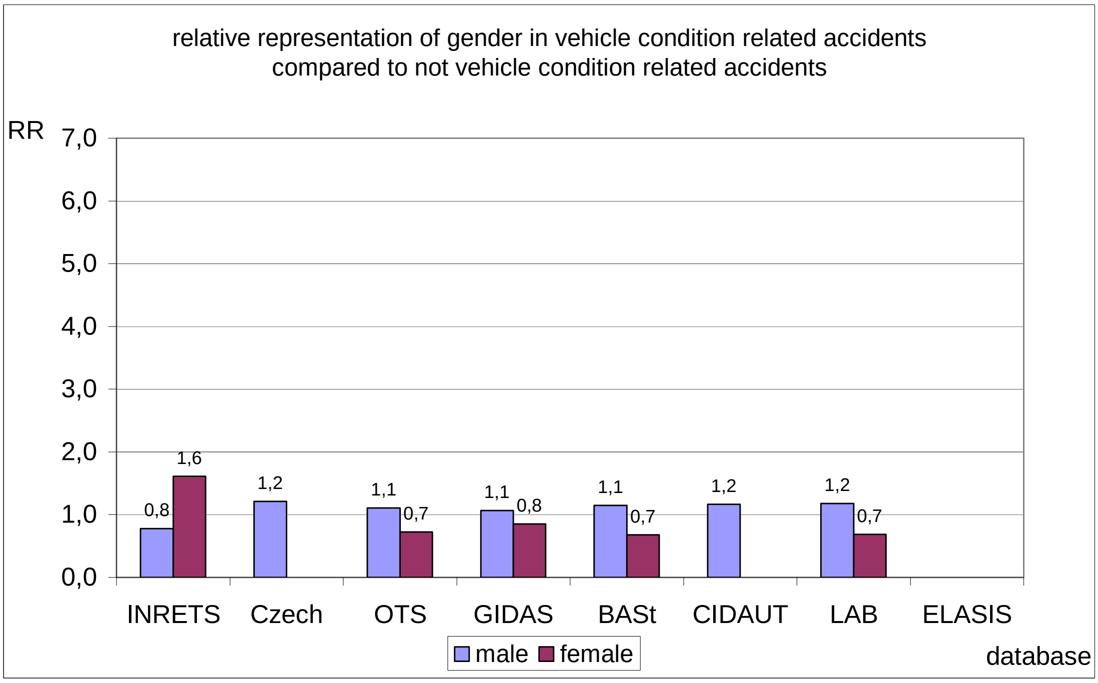
database	% of accidents in data sample	exact variable name
CIDAUT	0.3%	bad state of the vehicle
LAB	2.4%	mechanical defect
TNO Trucks	12.0%	mechanical defect

Relative representation in database

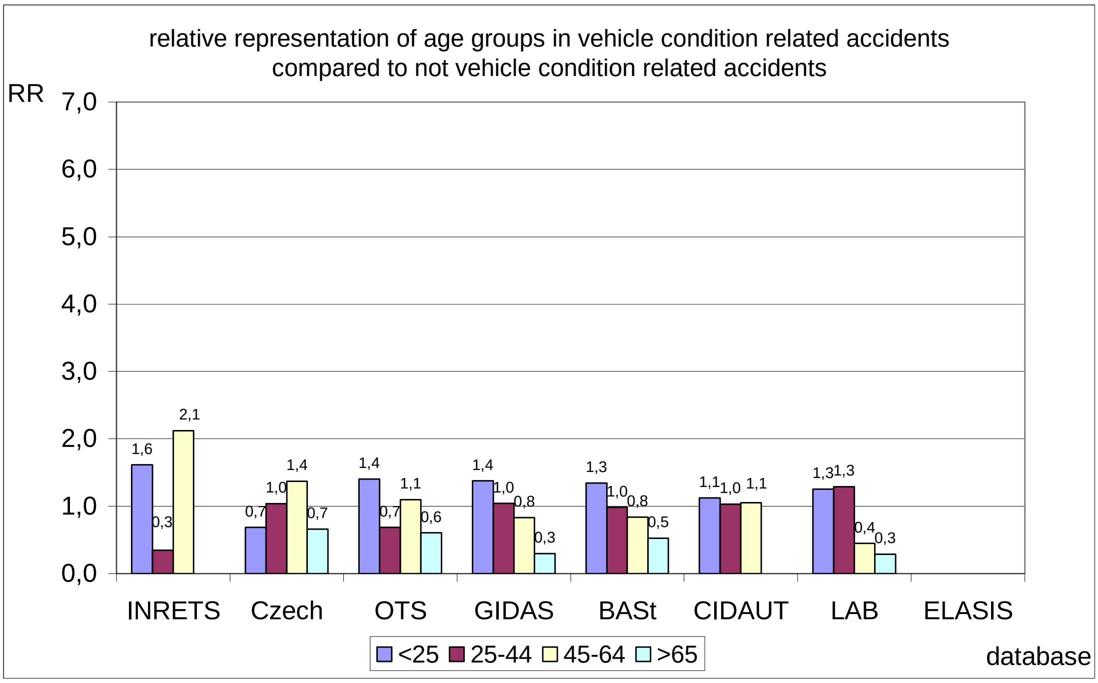
database	Contributory factor reported in accident	RR	
CIDAUT_in-depth	1.1. Tyres.	10,80	fatal RR
CIDAUT_in-depth	1.1. Tyres.	3,1	RR
OTS_in-depth	Tyre worn or insufficient tread	2,16	fatal RR
GIDAS_in-depth	defects tyres	1,89	fatal RR
LAB_in-depth	Mechanical defect	1,61	fatal RR
Monash_Australia_in-depth	Critical vehicle malfunction or defect (record the malfunction / defect in the vehicle record)	1,40	fatal RR
IDIADA_Catalonia_national	old tyres	1,27	fatal RR

Vehicle condition and explanatory variables

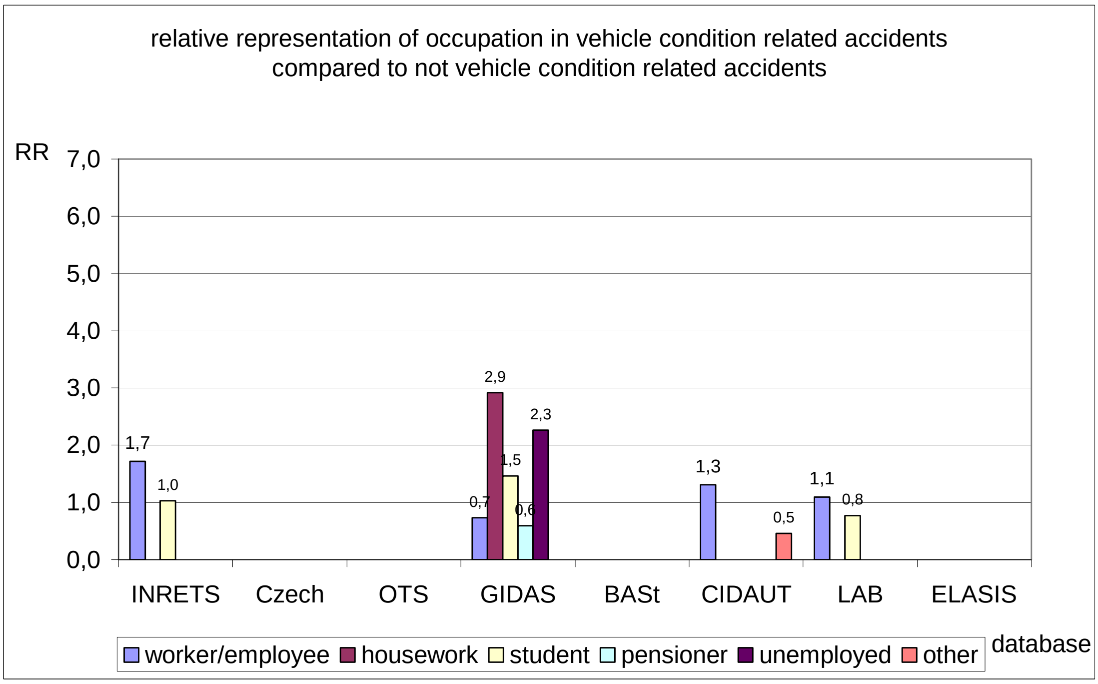
Data request 3B: results of preparation and Relative Risks in Comparison of the databases (graph) and calculation of OR with 95% Confidence intervals (only significant (level 0.05) results are presented) (table).



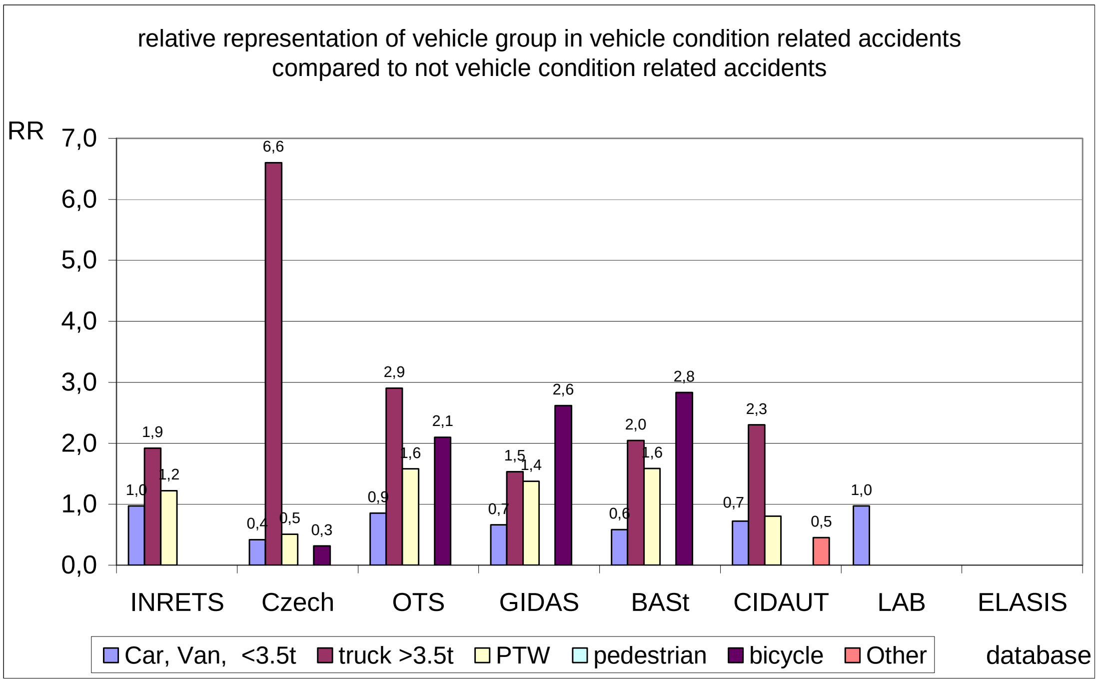
	Gender	OR	95% CI lower limit	95% CI upper limit
BASt	male	1,70	1,62	3,23



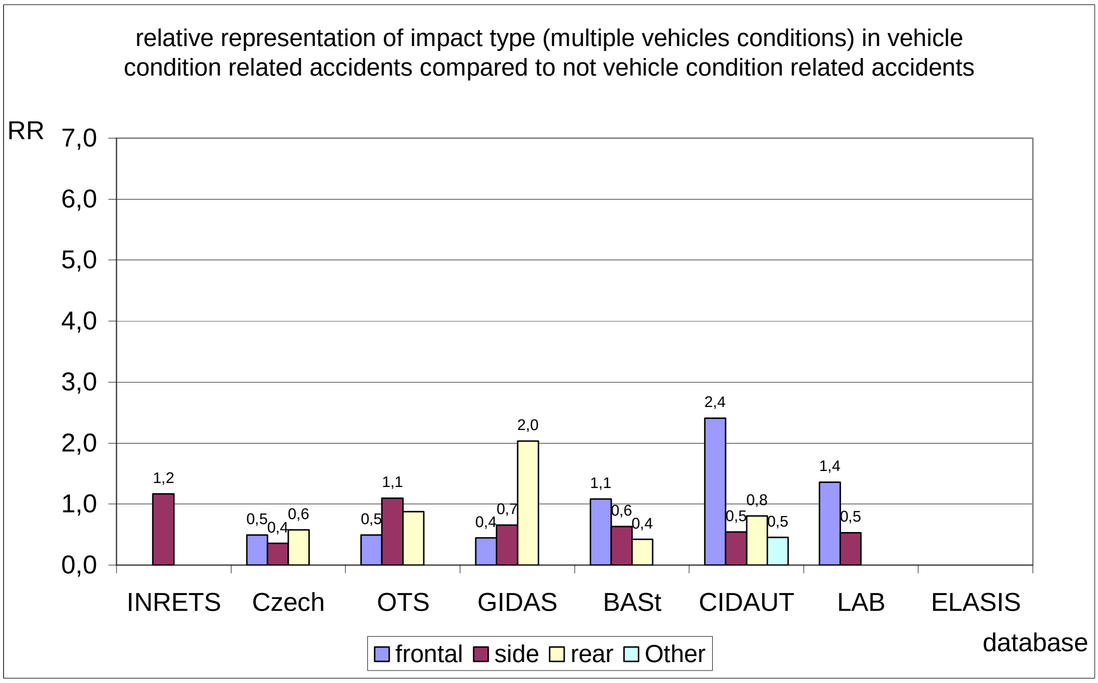
	Age group	OR	95% CI lower limit	95% CI upper limit
GIDAS	<25	1,62	1,02	4,07
BASt	<25	1,55	1,49	2,75



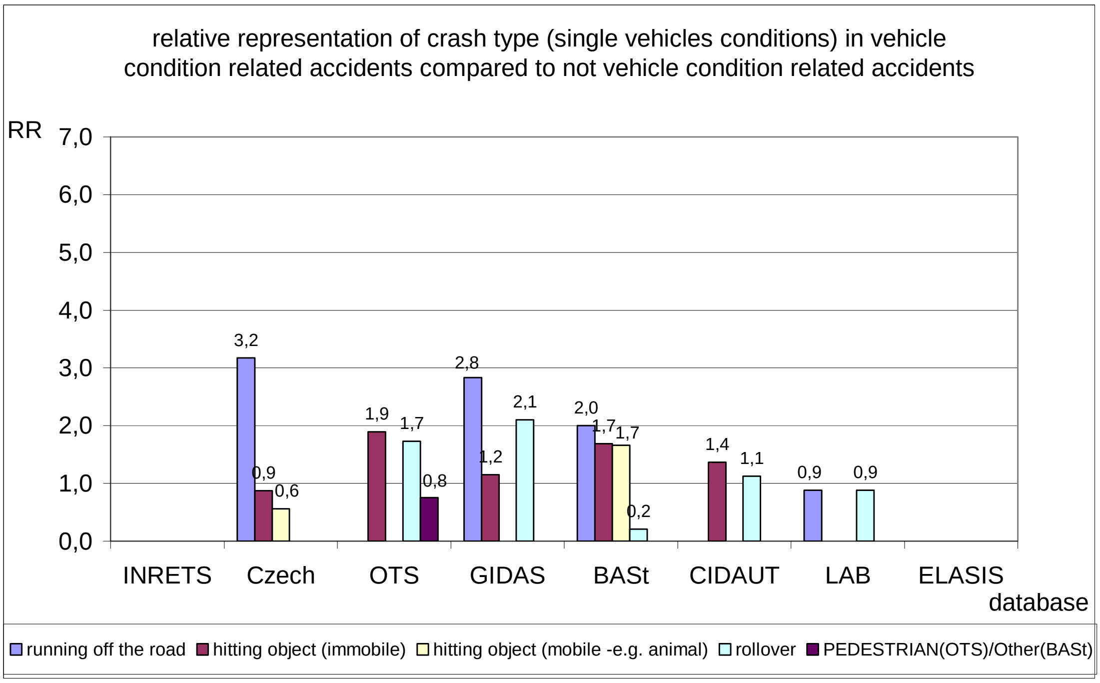
	occupation	OR	95% CI lower limit	95% CI upper limit
GIDAS	unemployed	2,60	1,15	13,35



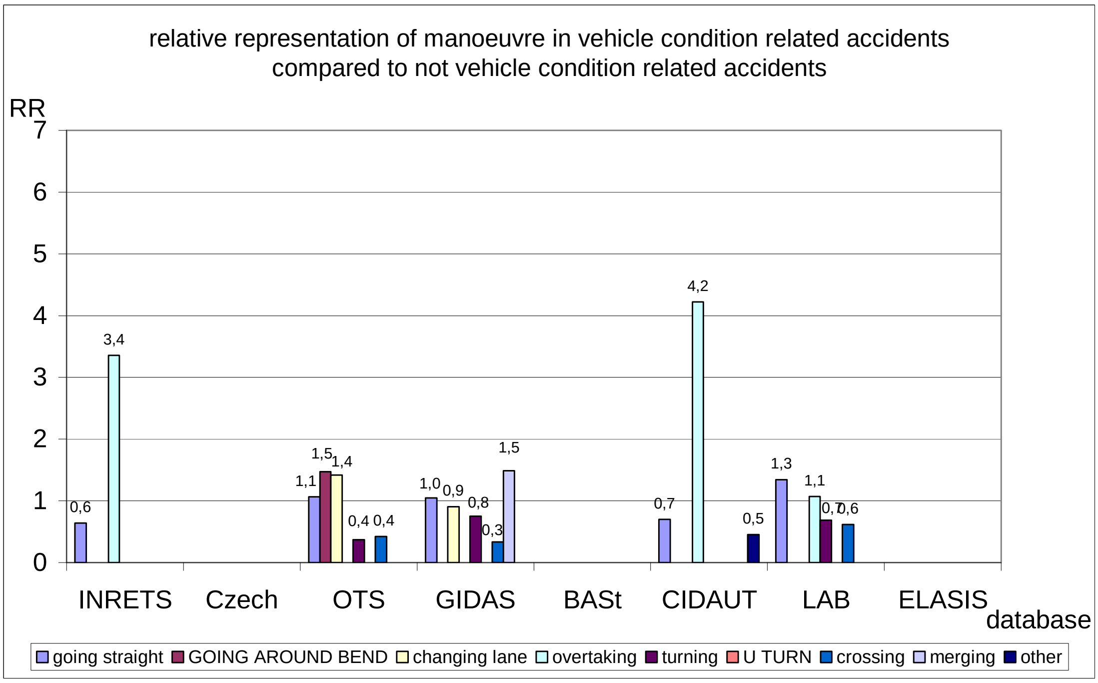
	Vehicle group	OR	95% CI lower limit	95% CI upper limit
Czech	truck >3.5t	14,20	8,27	26,62
OTS	truck >3.5t	3,26	1,45	16,18
GIDAS	bicycle	3,48	2,28	10,19
BASt	bicycle	3,59	3,45	7,42



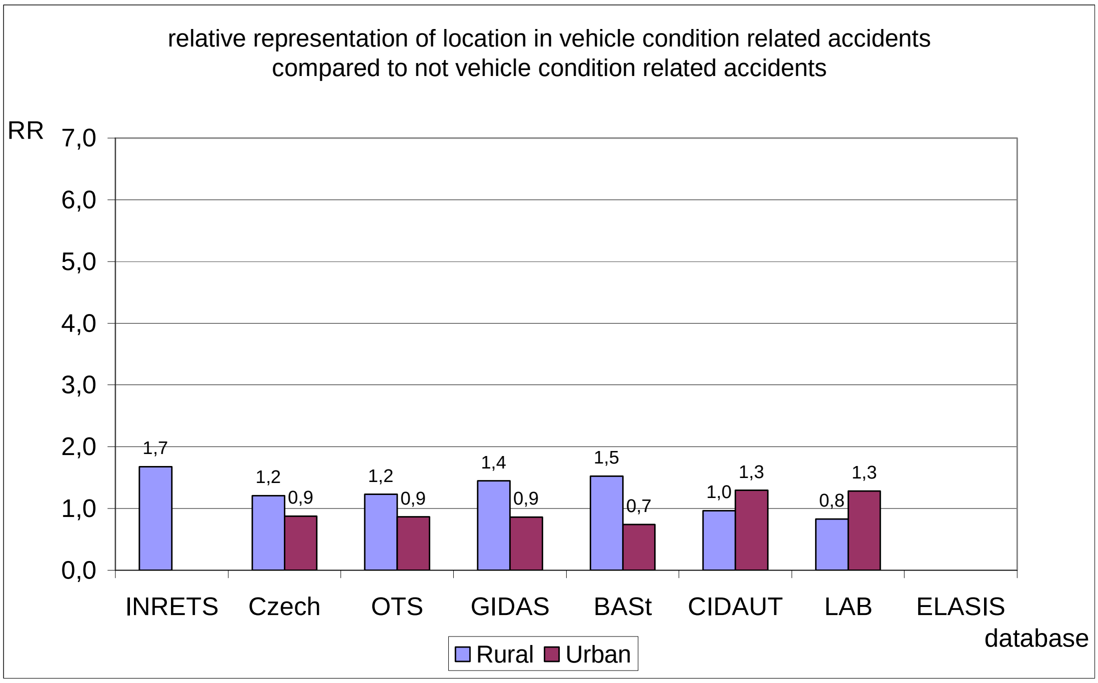
	impact type multiple vehicle collision	OR	95% CI lower limit	95% CI upper limit
Czech	Other	3,42	1,49	17,25
GIDAS	Other	3,16	1,87	10,56
BASt	frontal	1,66	1,55	3,16



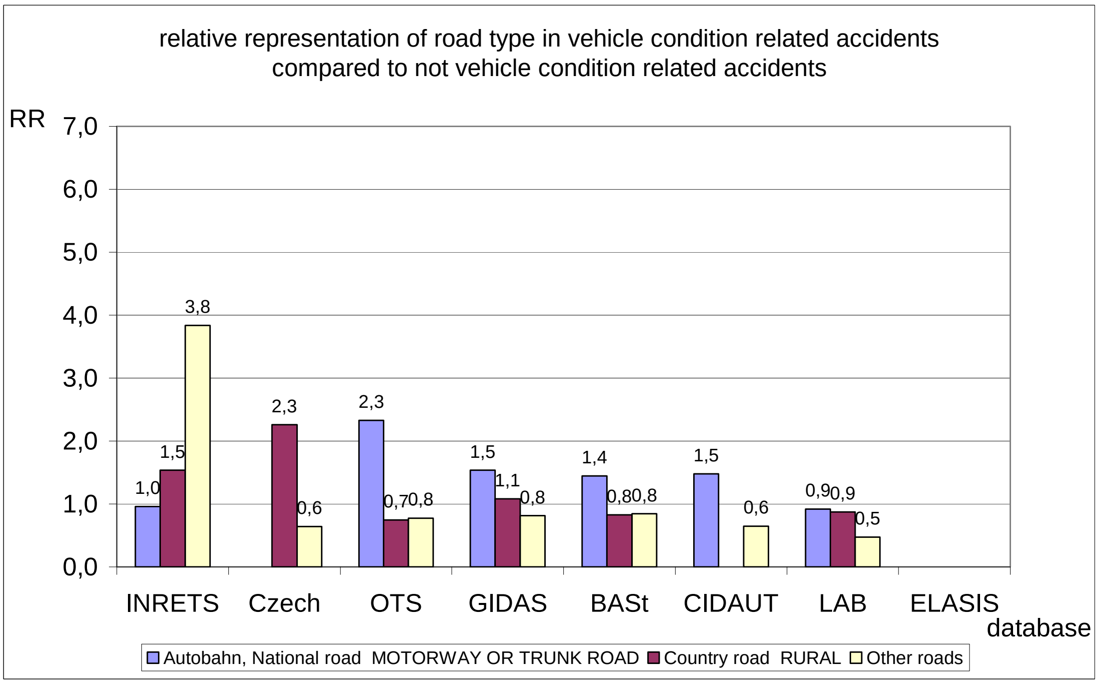
	crash type single vehicle	OR	95% CI lower limit	95% CI upper limit
Czech	running off the road	4,98	2,60	16,68
GIDAS	running off the road	2,37	1,13	10,61
BASt	Other	2,11	1,99	4,39



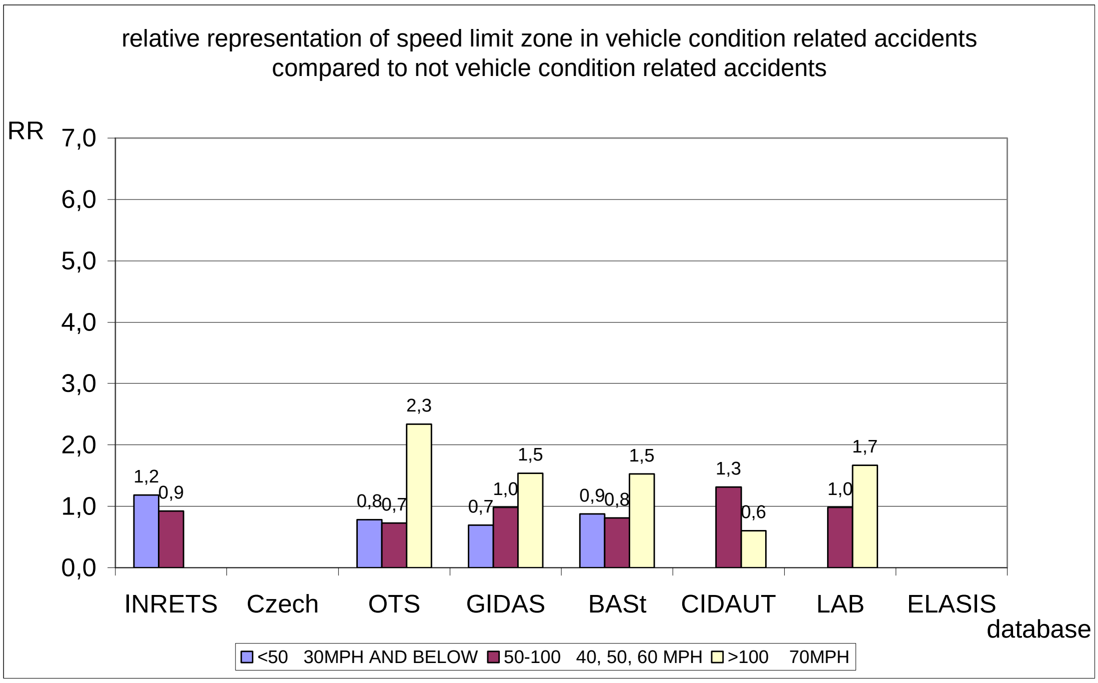
	manoeuvre	OR	95% CI lower limit	95% CI upper limit
OTS	other	2,38	1,31	8,66



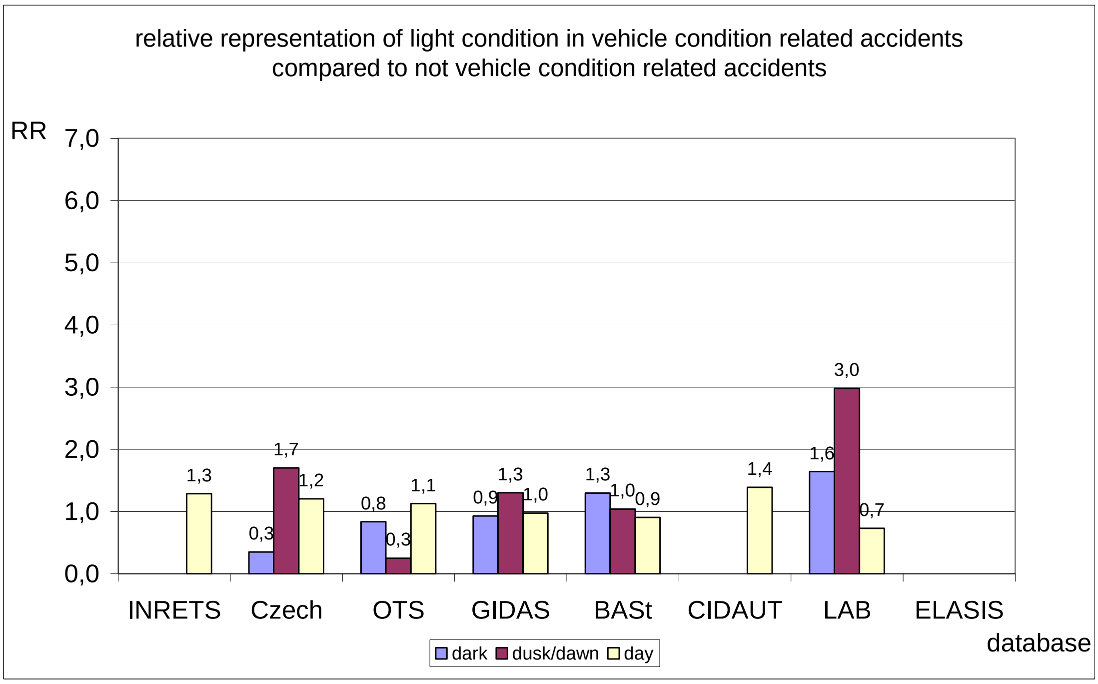
	Location	OR	95% CI lower limit	95% CI upper limit
GIDAS	Rural	1,69	1,07	4,40
BASt	Rural	2,06	1,98	4,20



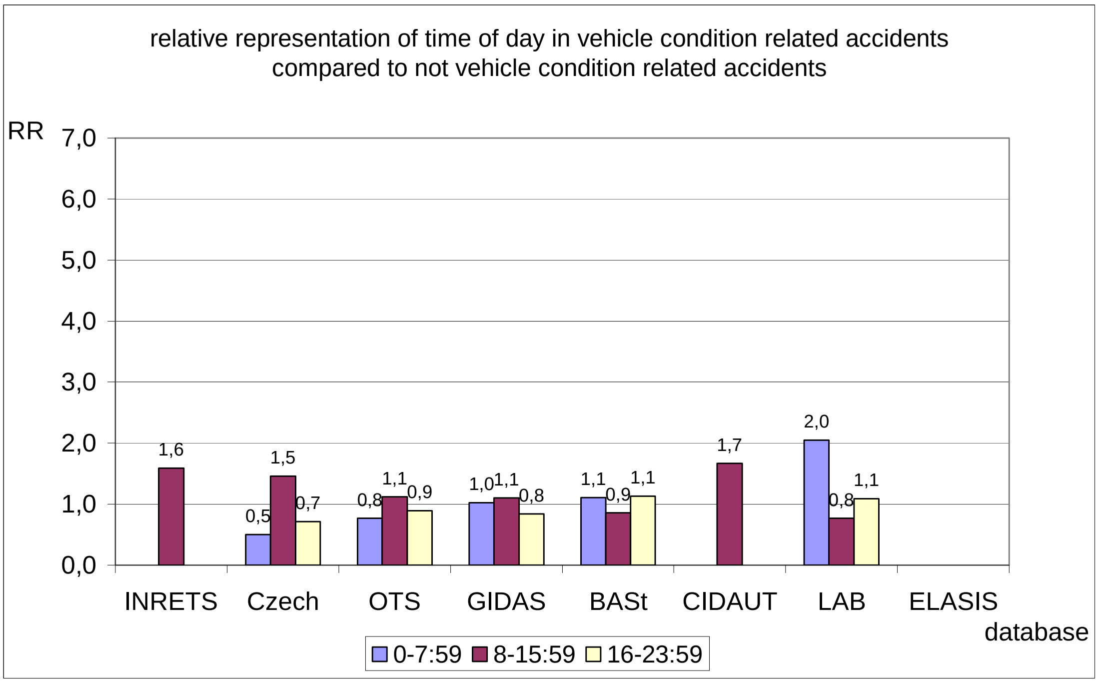
	Road type	OR	95% CI lower limit	95% CI upper limit
Czech	Country road	3,60	1,84	14,15
OTS	Autobahn, National road MOTORWAY OR TRUNK ROAD	3,05	1,74	10,65
GIDAS	Autobahn, National road	1,75	1,08	4,84
BASt	Autobahn, National road	1,72	1,65	3,27



	Speed limit	OR	95% CI lower limit	95% CI upper limit
OTS	>100 70MPH	3,08	1,76	10,78
BASt	>100	1,56	1,44	2,87



	light conditions	OR	95% CI lower limit	95% CI upper limit
Czech	dark	0,28	0,78	0,01
BASt	dark	1,42	1,36	2,34
LAB	day	0,40	0,78	0,04



	time of day	OR	95% CI lower limit	95% CI upper limit
Czech	0-7:59	0,34	0,96	0,04
BASt	0-7:59	1,29	1,22	1,95
Czech	16-23:59	0,49	0,98	0,12
BASt	16-23:59	1,32	1,27	2,03

Summary

Method: Cross tabs with OR and 95% Confidence interval

Factor	Partner	Results from data request 3B
Vehicle Condition	INRETS	No significant associations
Vehicle Condition	Czech national	Country road ↑ Dark ↓ 8-15:59 ↑↑
Vehicle Condition	OTS	truck >3.5t ↑ other ↑ Autobahn, National road MOTORWAY OR TRUNK ROAD ↑ >100 70MPH ↑
Vehicle Condition	GIDAS	<25 ↑ Unemployed ↑ Bicycle ↑ Other impact types ↑ running off the road ↑ Rural ↑ Autobahn, National road ↑
Vehicle Condition	BASt	Male ↑ <25 ↑ Bicycle ↑ Frontal ↑ Other crash types (single vehicle crashs) ↑ Rural ↑ Autobahn, National road ↑ >100 ↑ Dark ↑ 16-23:59 ↑
Vehicle Condition	DIANA	No significant associations
Vehicle Condition	LAB	Day ↑

Table 7-4: Vehicle Trip-related factor: vehicle condition

Annex VI Road layout and road geometry

Road layout and geometry – data request 3A result

Descriptive

database	% of accidents in data sample	exact variable name
DIANA	0%	lack of visibility of the vertical and horizontal signalling
IDIADA ETAC	0%	inadequate signs and signals
GIDAS BASt	0%	road signs
DIANA	0%	lack of necessary signalling
DIANA	0%	wrong signalling: inappropriate state and/or mainentance
INRETS	0.0%	Problem in the direction road signs
INRETS	0.0%	Problem in the pre-signing (not sufficient, not visible)
BASt	<0.1%	irregular condition of traffic signs or installations
STATS 19	0.2%	defective traffic signals
CIDAUT	0.1%	state of the signals
OTS	0.2%	Inadequate signing at site
STATS 19	0.5%	inadequate/masked signs or markings
LAB	2.1%	poor sign posting
LAB	2.3%	misleading infrastructure
TNO MAIDS 2000	8.0%	traffic control signals defect / malfunctioning
INRETS	9.3%	Problems in equipment (atypical, not legible, not adapted to certain vehicles)
database	**% of accidents in data sample**	**exact variable name**
GIDAS BASt	0%	street lighting
INRETS	0%	problem in lighting the site
BASt	<0.1%	insufficient road lighting
OTS	0.4%	Poor or no street lighting at site
Czech Republic	10.2%	at night, without public lighting – undeteriorated due to weather conditions
Czech Republic	11.2%	at night, with public lighting – undeteriorated due to weather conditions
database	**% of accidents in data sample**	**exact variable name**
DIANA	0%	inadequate design of the road (small curvature radius / inverted banking)
OTS	0.4%	surroundings obscured by winding road at site
STATS 19	1.8%	vision affected by road layout
OTS	2.2%	bend or winding road at site
STATS 19	2.8%	road layout
Czech Republic	3.1%	view conditions bad due to road profile (badly arranged top of the hill, road cutting etc.)
HIT	6%	road design
LAB	6.5%	surroundings obscured by infrastructure or roadside element or road geometry
TNO MAIDS 2001	6.7%	Roadway design defect
TNO MAIDS 2000	10.6%	Roadway design defect

INRETS	11.6%	difficult site (low radius in bend, rupture)
database	**% of accidents in data sample**	**exact variable name**
OTS	0.2%	narrow road at site
LAB	2.1%	narrow road
INRETS	2.3%	narrow road
database	**% of accidents in data sample**	**exact variable name**
OTS	0.2%	steep hill at site

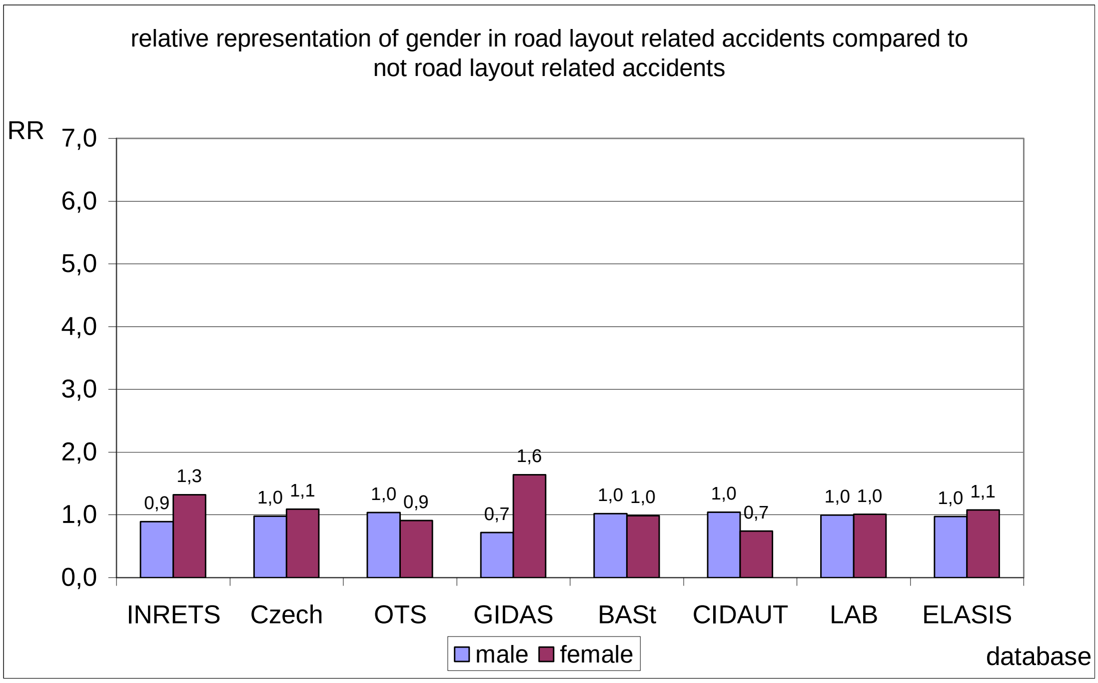
Table 7-5: Environment Trip-related factor: road condition/layout/geometry

Relative representation in database keyword – road layout

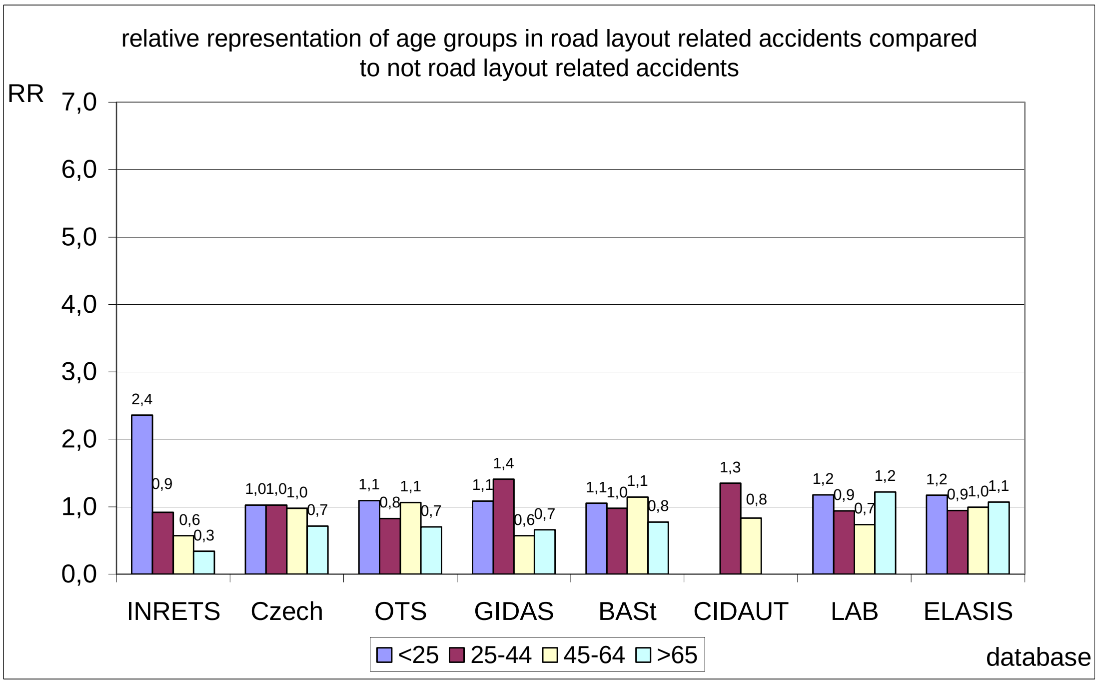
database	Contributory factor reported in accident	RR	
TUG_Austria_in-depth	Road geometry, Bend	5,96	fatal RR
LAB_in-depth	Roadside shoulders not driveable (step, bank, trees…)	3,43	fatal RR
LAB_in-depth	Roadside shoulders not driveable (step, bank, trees…)	2,0	RR
INRETS_in-depth	- Difficult site (low radius in bend, rupture)	1,8	RR
LAB_in-depth	Misleading infrastructure	1,54	fatal RR
TUG_Austria_in-depth	Road side infrastructure, Tree	1,50	fatal RR
INRETS_in-depth	- Problems in equipment (atypical, not legible, not adapted to certain vehicles)	1,4	RR
LAB_in-depth	Narrow road	1,40	fatal RR
LAB_in-depth	Poor signposting	1,40	fatal RR
TUG_Austria_in-depth	Road side infrastructure, Fill slope	1,34	fatal RR
MAIDS_NL_2000_in-depth	tram/train rails	1,23	fatal RR
Stats_GB_national	Road layout	1,22	fatal RR
Czech_national	bad due to road profile (badly arranged top of hill, road cutting etc.)	1,16	fatal RR

Road layout and condition and explanatory variables

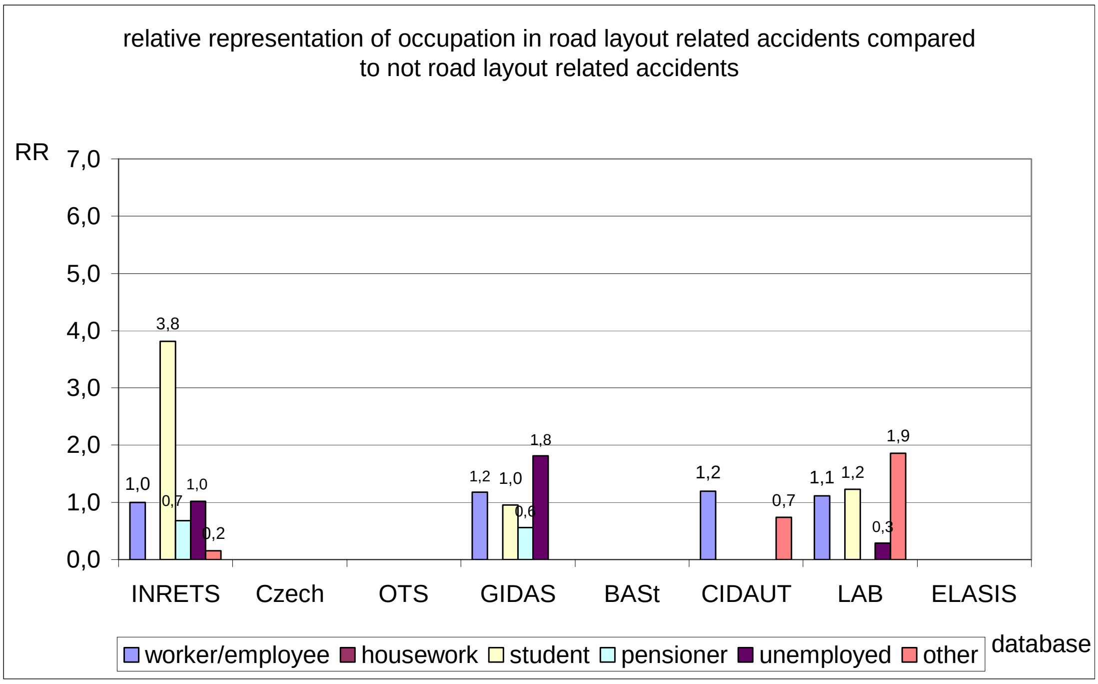
Data request 3B: results of preparation and Relative Risks in Comparison of the databases (graph) and calculation of OR with 95% Confidence intervals (only significant (level 0.05) results are presented) (table).



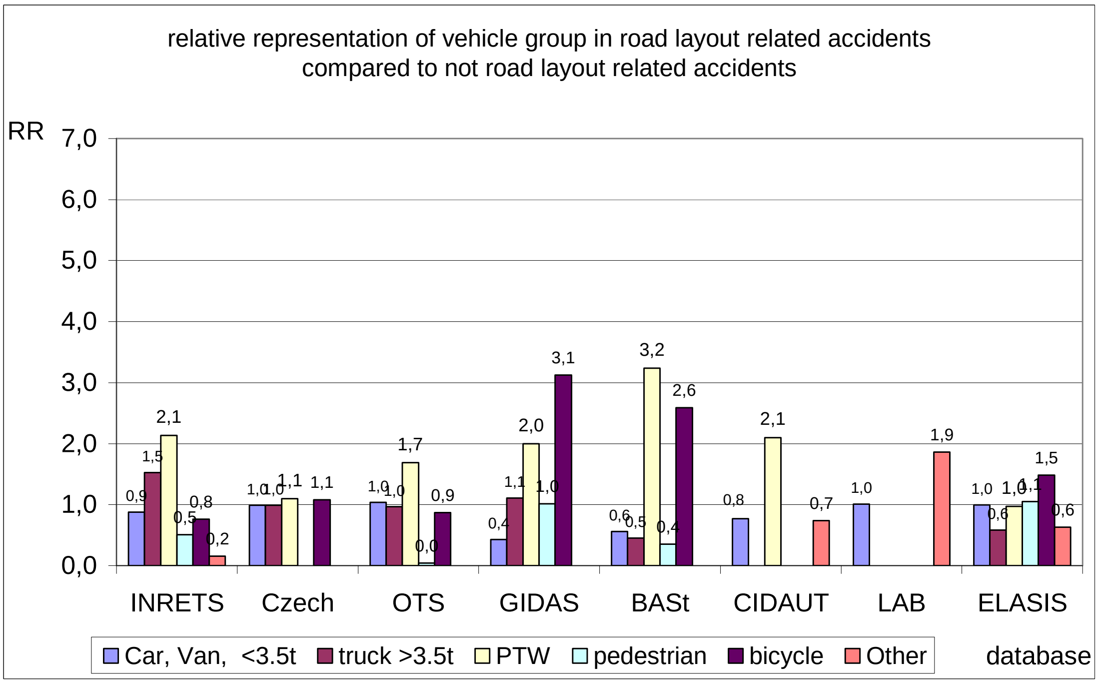
	Gender	OR	95% CI lower limit	95% CI upper limit
Czech	male	0,90	0,96	0,73
ELASIS	male	0,90	0,94	0,73



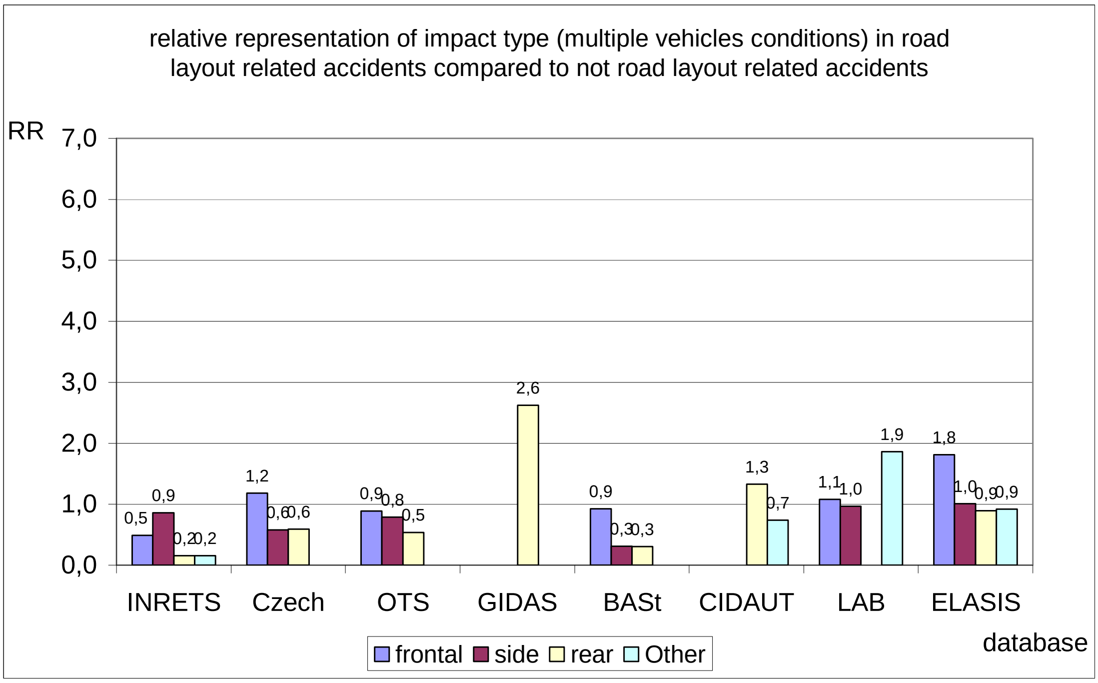
	Age group	OR	95% CI lower limit	95% CI upper limit
BASt	45-64	1,19	1,11	1,64
ELASIS	<25	1,21	1,16	1,67



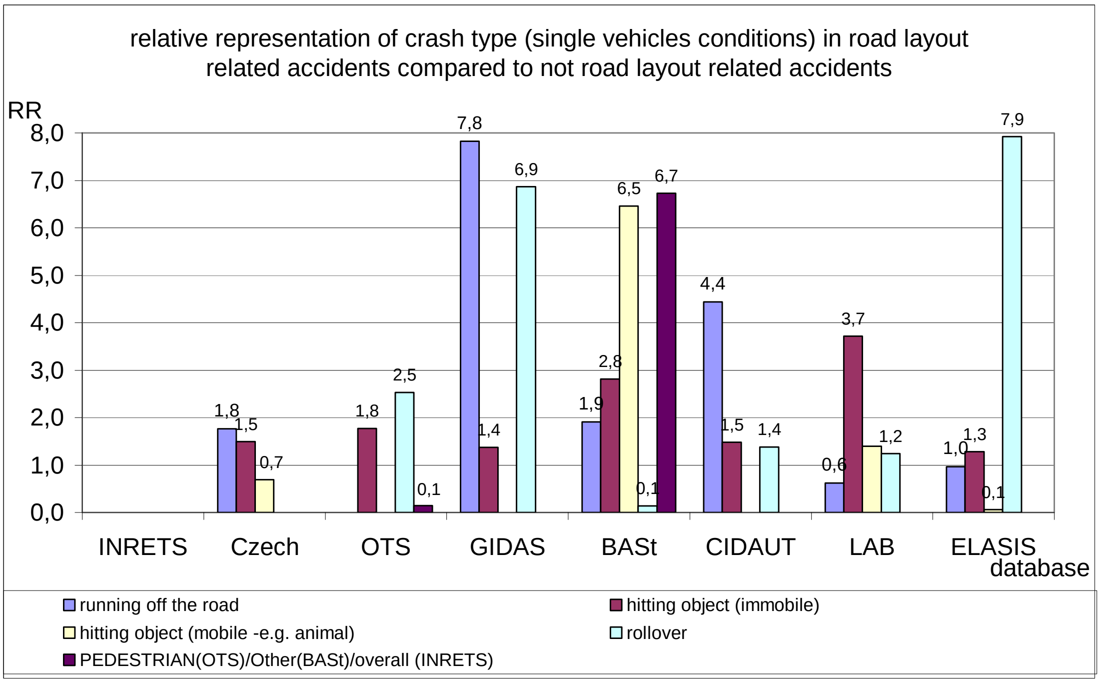
	occupation	OR	95% CI lower limit	95% CI upper limit
INRETS	student	4,75	1,28	51,63



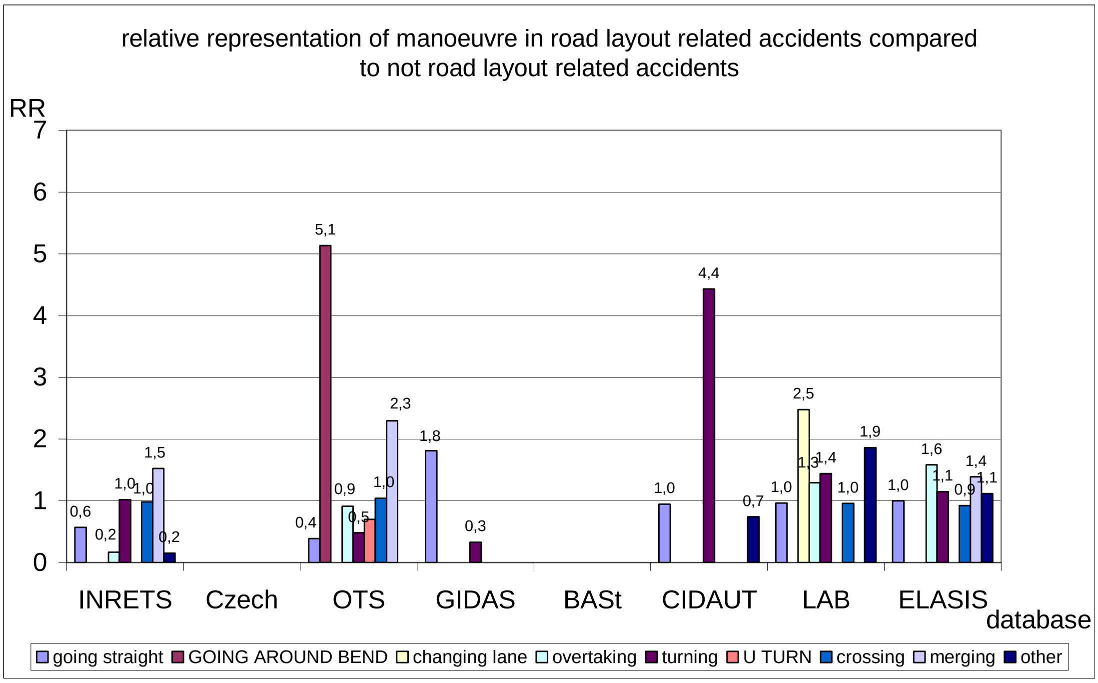
	Vehicle group	OR	95% CI lower limit	95% CI upper limit
OTS	PTW	1,78	1,17	4,72
BASt	PTW	3,96	3,70	8,19
ELASIS	bicycle	1,51	1,40	2,69



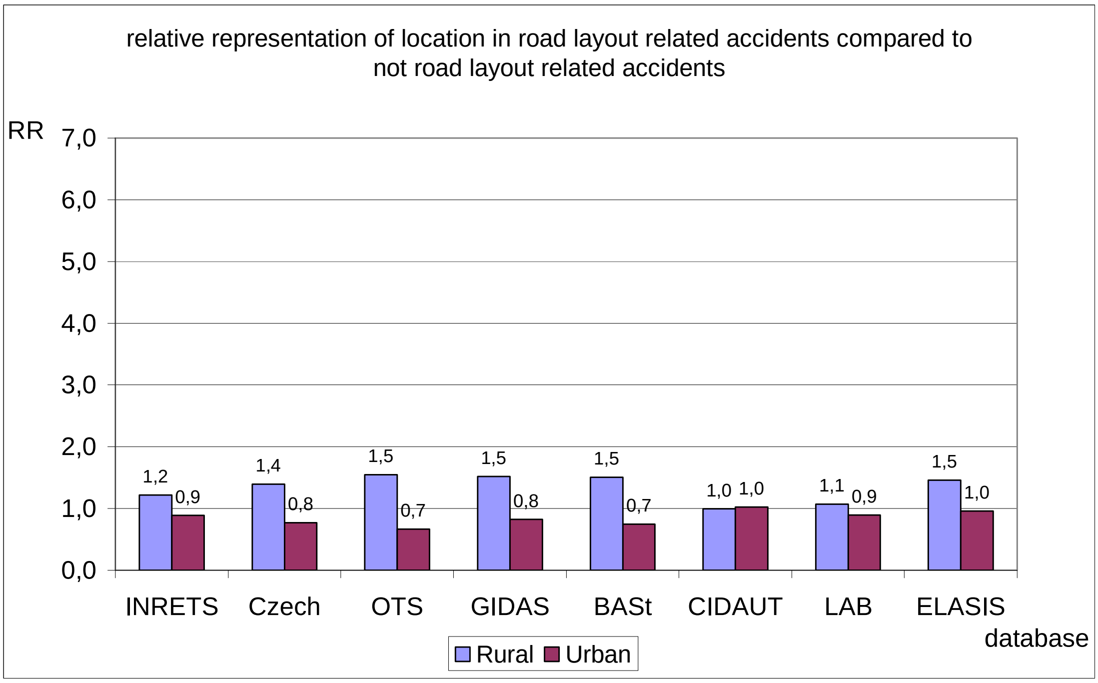
	impact type multiple vehicle collision	OR	95% CI lower limit	95% CI upper limit
Czech	Other	1,72	1,63	3,29
BASt	frontal	2,85	2,52	6,46
ELASIS	frontal	1,87	1,68	3,91



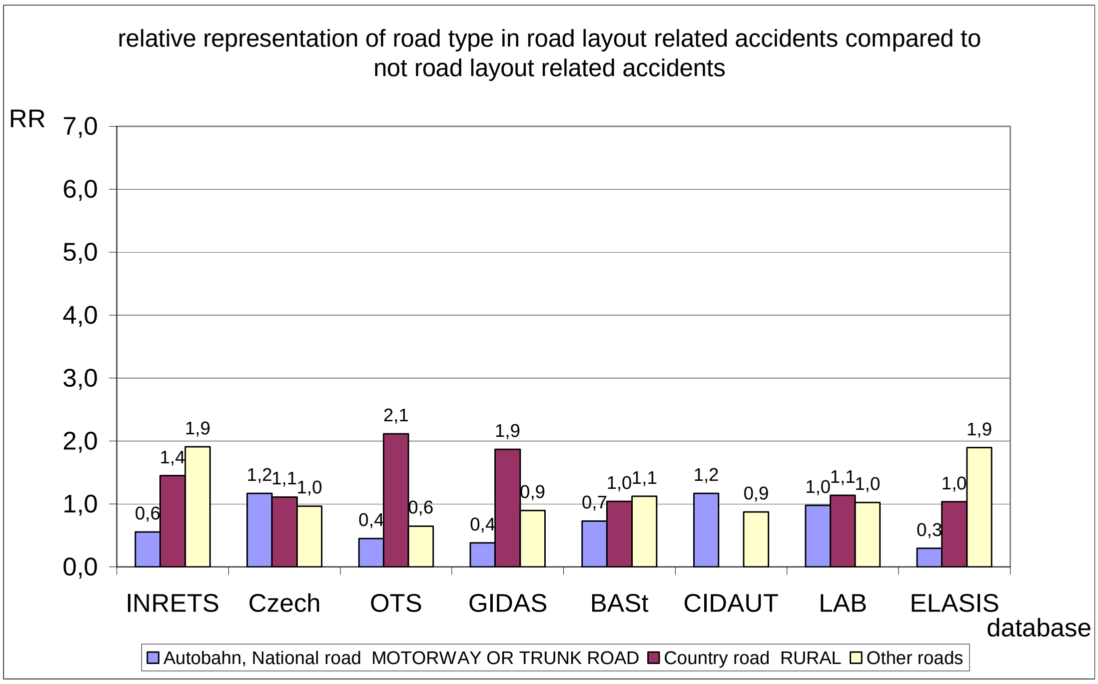
	crash type single vehicle	OR	95% CI lower limit	95% CI upper limit
Czech	running off the road	2,01	1,89	4,13
OTS	rollover	1,69	1,06	4,47
GIDAS	running off the road	4,32	1,09	60,53
BASt	Other	3,07	2,85	6,63
ELASIS	hitting object (immobile)	1,42	1,22	2,47



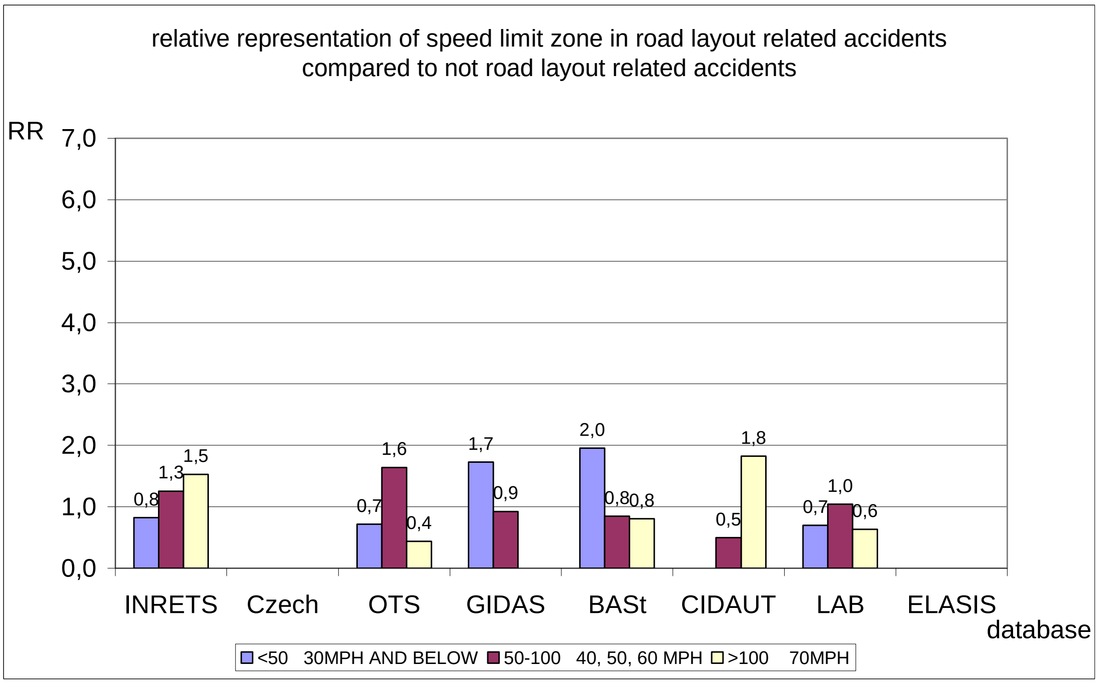
	manoeuvre	OR	95% CI lower limit	95% CI upper limit
OTS	GOING AROUND BEND	8,77	6,77	16,45
ELASIS	crossing	0,87	0,90	0,63



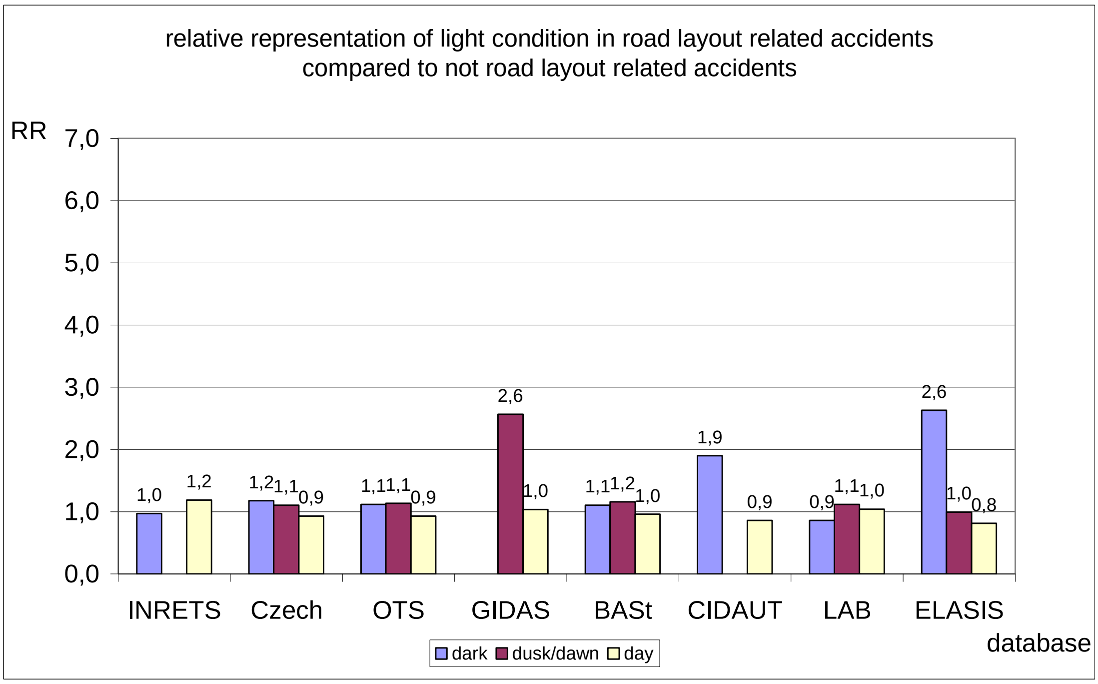
	Location	OR	95% CI lower limit	95% CI upper limit
Czech	Rural	1,81	1,72	3,57
OTS	Rural	2,32	1,78	5,88
BASt	Rural	2,01	1,89	4,14
ELASIS	Rural	1,52	1,41	2,73



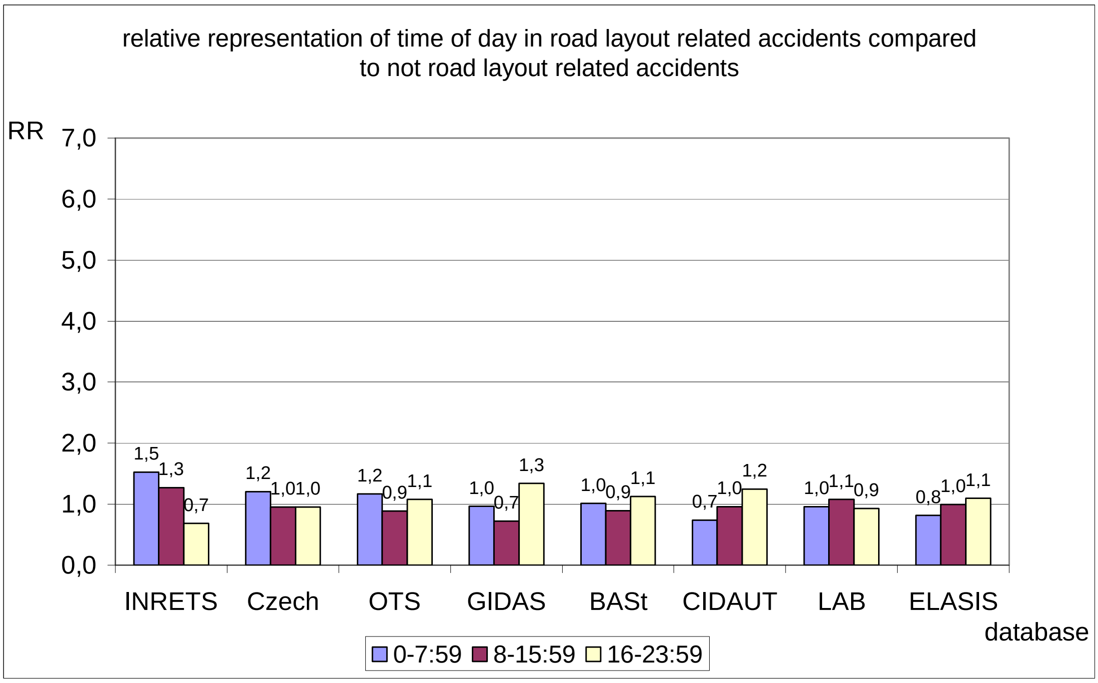
	Road type	OR	95% CI lower limit	95% CI upper limit
Czech	Country road	1,15	1,08	1,48
OTS	Country road RURAL	3,52	2,73	8,70
BASt	Other roads	1,30	1,22	1,97
ELASIS	Country road	1,31	1,22	2,03



	Speed limit	OR	95% CI lower limit	95% CI upper limit
OTS	>100 70MPH	3,08	1,76	10,78
BASt	<50 km/h	2,07	1,88	4,42



	light conditions	OR	95% CI lower limit	95% CI upper limit
Czech	dark	1,25	1,18	1,82
BASt	dark	1,14	1,06	1,44
ELASIS	dark	3,15	2,80	7,06



	time of day	OR	95% CI lower limit	95% CI upper limit
Czech	0-7:59	1,26	1,17	1,85
BASt	0-7:59	1,13	1,03	1,43
BASt	16-23:59	1,26	1,18	1,86
ELASIS	0-7:59	0,82	0,88	0,53
ELASIS	16-23:59	1,10	1,04	1,31

Summary

Method: Cross tabs with OR and 95% Confidence interval

Factor	Partner	Results from data request 3B
Road layout	INRETS	Student ↑
Road layout	Czech national	Male ↑ Other type of impact ↑ running off the road ↑ Rural ↑ Country road ↑ Dark ↑ 0-7:59 ↑
Road layout	OTS	PTW↑ rollover↑ GOING AROUND BEND ↑↑ Rural↑ Country road RURAL↑
Road layout	GIDAS	running off the road ↑
Road layout	BASt	45-64↑ PTW↑ frontal↑ Other type of single vehicle crash↑ Rural↑ Other roads↑ <50↑ dark↑ 16-23:59↑
Road layout	DIANA	No significant associations
Road layout	LAB	No significant associations
Road layout	ELASIS	male ↓ <25↑ bicycle↑ frontal↑ crossing↑ hitting object (immobile) ↑ Rural↑ Country road↑ dark↑ 16-23:59↑ 0-7:59 ↓

Table 7-6: Environment Trip-related factor: road layout

List of Abbreviations

AIS:	Abbreviated Injury Scale.
DIANA:	in-Depth Investigation and ANalysis of Accidents.
Delta-V:	Subtraction between 'Post-impact speed vector' and 'Pre-impact speed vector'
Df:	Degree of freedom.
EBS:	Energy Barrier Speed
EES:	Energy Equivalent Speed.
ETS:	Equivalent Test Speed
GDL:	Graduated Driver's License
HP:	Horse Power
Sig.	Significance level
ISA:	Intelligent Speed Adaption
LKA:	Lane Keeping Assistance
ESP:	Electronic Stability Program
BA:	Brake Assistance
ACC:	Active Cruise Control
CA:	Collision Avoidance
SAVE-U:	Vulnerable Road Users Protection
NV:	Night Vision
DDD:	Driver Drowsiness Detection
LCA:	Lane Changing Assistance,
AAFS	Advanced Adaptive Front light System
TPM:	Tyre Pressure Monitoring and Warning Systems
CW:	Collision Warning