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Methods of multidisciplinary in-depth analyses of road traffic accidents

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Abstract

A multidisciplinary Road Accident Analysis Group with the objective of conducting in-depth investigations of specific types of accidents has existed in Denmark for some years. The group has analysed head-on collisions, left-turn accidents, truck accidents and single vehicle accidents. The data collection included police reports, the group's investigation of accident sites and vehicles involved, and interviews with the involved road users and witnesses.

The main accident factors in the head-on collisions and in the single vehicle accidents were excessive speed, drunk driving and driving under the influence of illegal drugs. The primary accident factors in left-turn accidents were attention errors or misjudging the amount of time available to complete the left turn. In the truck accidents insufficient searching for visual information as well as speeding were major factors. For all the accident themes the primary injury factor was failure to wear seat- belts.

The multidisciplinary approach has provided a rather precise knowledge of the contributing factors leading up to the accident. The method requires a lot of resources, which is a limiting factor for the number of accidents to be analysed in this way. However, the method is suitable for analysis of common occurring or very serious types of accidents.

Keywords: Accident investigation; Accident analysis; Accident factors; Passenger cars; Heavy vehicles

1. Introduction

During the recent years, in-depth studies of road accidents have been carried out in several countries and by using various methods (see for instance [1–3]). In the Nordic countries, multidisciplinary accident investigation teams in Finland have been studying fatal accidents since 1968. They have covered almost all fatal accidents involving a motor vehicle as well as those with personal injuries from more specific types of accidents. The work is organised by the traffic safety committee of insurance companies in co-operation with the road traffic authorities and the accident research organisations [4]. Sweden has used multidisciplinary accident investigation teams on a trial basis in 1976–1978, using a theoretically based behavioural science approach with the importance attached to the pre-crash phase [5]. The same method was used in 1991–1994 by new accident investigation teams, initiated and financed by the Swedish National Road Administration [6]. In Denmark, a multidisciplinary team carried out in-depth analyses for some years in the 1960s, focusing on the pre-crash phase [7].

As part of the national efforts to prevent road traffic accidents, multidisciplinary in-depth analyses have been carried out again for the last 7 years by the Danish Road Accident Analysis Group, settled by the Danish Ministry of Transport.

1.1. The road accident analysis group

The Road Accident Analysis Group worked for the first 5 years on a trial basis. The idea during the trial period was to develop an appropriate method for in-depth analyses and to test the methods on selected types of accidents. In 2001, the group was set up permanently based on the developed method, and consisted of motor vehicle inspectors, highway engineers, traffic psychologists, police officers and a physician, in total of 10 persons. Thus, the group was composed of professionals from different specialist fields and institutions. The objective of the group was to conduct in-depth analyses of specific accident types and on this basis, to illuminate what happened not only before but also during and immediately after the accident. Further, the group if possible should recommend accident prevention measures or areas for more detailed research.

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The accident types were divided into themes, and no isolated specific accident was analysed. The selected themes were dealt with one at a time.

From the start, none of the involved specialists had worked with in-depth analysis before but all participants brought with them their own area of expertise. Thus, most of the first 6 months of the trial period were spend discussing the method to apply, making contacts and visiting the Finnish accident investigation team to learn from their method and investigations. The experience with the specific method applied in the Danish in-depth analyses had to be developed during the work.

The Analysis Group is operating purely on a research level and all the information collected is confidential—neither the police nor the insurance companies are allowed access to the findings of the individual accidents. Thus, it is not the intention to assess legal guilt.

1.2. The analysed accident types and numbers

As the work of the Road Accident Analysis Group in the trial period was a part of each team member's every day work, it was clear from the start that it was possible to analyse only a limited amount of accidents—it was estimated that about 15–20 accidents within each accident type would be realistic and at the same time sufficient to provide a picture of the most important accident factors. When the group was permanently set up, the team members were allowed more time for disposal and thus, the aim became about 40 accidents per selected accident type.

No strict selection criteria were applied in the choice of accident types to be analysed, but considerations such as seriousness, frequency and risk compared to other accident types has been in focus.

Head-on collisions were chosen as the first object to analyse in the trial period, as the consequences of these accidents are often very serious. Thus, from 1986 to 1995 in Denmark, an average of almost 130 fatalities were recorded each year in connection with head-on collisions which was more than 20% of all fatalities. Seventeen head-on collisions were analysed [8].

Accidents with left-turning vehicles were chosen because it was a frequently occurring type of accident. In the 10-year period prior to the study (1987–1996), left-turn accidents accounted for 17% of all police registered accidents. About 8% of all fatalities and about 16% of all those seriously injured in traffic resulted from such accidents. Thus, left-turn accidents accounted for a considerable portion of the serious injuries, while the share of fatalities was relatively low. Also in this accident type 17 accidents were analysed [9].

As the last topic in the trial period, 21 truck accidents were analysed. This accident type was chosen because trucks play a far larger role in the total road accident picture in Denmark than their number and mileage entitle them to. Seventeen percent of all killed in 1999 were killed in accidents with trucks involved. The accident risk of trucks is about twice as high and the risk for a fatal accident about six times as high as accidents with passenger cars [10].

After the group was permanently set up, 32 single vehicle accidents with 18–24 years old drivers have been analysed. Single vehicle accidents are frequently occurring in accidents with young people. In 2001, one in four traffic accidents with drivers under the age of 25 years, was a single vehicle accident [11].

The current theme is accidents on motorways. The selection of this accident type was caused by the fact that the number of accidents on motorways is increasing, the number of personal injuries is increasing, and more persons are injured per accident. Furthermore, a bill was in the pipeline concerning increased speed limits on motorways. The results from these analyses have not yet been reported and therefore, this last theme is not included in the following.

Table 1 shows the mean number per year of injury accidents, of the selected accident types and the mean number of killed and seriously injured per year over the years 1998–2002.

Table 1 shows that the tendencies mentioned above are confirmed in the national statistics from 1998 to 2002. Head-on collisions is still an accident type with very serious consequences and accounts for about 20% of all killed. Accidents with left-turning vehicles account for more than 20% of all the police registered injury accidents, and they account for 21% of all seriously injured. About 17% of all killed were killed in an accident with trucks involved and about 17% of all killed were <25-year-old drivers killed in a single vehicle accident.

2. Theoretical and methodological framework

On the basis of statistics from the previous years, a number of police districts were selected, where a sufficient number

Table 1
Mean number per year of injury accidents, of the number of each accident type and of the mean number of killed and seriously injured per year over the years 1998–2002

Accident type	Mean number of accidents	Mean number of persons killed	Mean number of persons seriously injured
Head-on collisions	608	109	476
Left-turning vehicles	1570	60	856
Truck accidents	497	80	252
Single vehicle accidents, young drivers	412	80	677
All injury accidents	7299	481	4116

of the accident type in question could be expected within a specified time-frame. Each relevant accident that occurred within the defined period was immediately reported to the team from the selected police districts.

Apart from the demarcation of the accident type, the only criterion for including an accident for analysis was that at least one of the road users was killed or that the injuries had lead to admittance to a hospital for one of the road users. There was no other selection procedure.

The applied method reflects to a great extent the method used by Swedish accident investigation teams [5,6]. The theoretical and methodological framework is based on a behaviour-oriented systems approach with the road user as both a component of a man–vehicle–environment system and also via information, decision-making processes and actions as an operator. According to this approach, the human causes of an accident can be seen as a breakdown in the information processing. The approach is more explicitly described in Section 2.2.

As causes of accidents are related to man, vehicle or the environment, and are often seen as emerging from the interaction between these elements, the professional expertise within these three areas (i.e. psychologist, road engineer and vehicle inspector) must fundamentally be present in the stage of data collection as well as in the stage of the analysis work. It is neither suitable nor sufficient that one person only visits the accident site, or one person only carries out the accident analysis and afterwards, just presents these views to the other members for further discussion. In that case, important information and points of views may be lost already when visiting the accident site or in the first presentation of the accident analysis results.

The human, vehicle and environmental factors were examined with respect to the pre-crash, crash and post-crash phases with the main emphasis on the pre-crash phase.

The analyses were based on information from local police, road authorities, vehicle inspectors, hospital journals and blood analyses. In addition, the group members visited the accident sites, interviewed the parties directly involved as well as witnesses and where possible examined the damaged vehicles.

2.1. Data collection

When a potentially relevant accident occurred, the team co-coordinator was informed by a contact person from the local police about the exact accident situation and when and where it had occurred. The contact person supplied the team co-coordinator with up-dated information regarding the police investigation of the accident and continued to send report documents as they were completed:

2.1.1. Investigations on the site of the accidents

Data have been collected in two ways: police reports and vehicle inspection reports, and from the local authorities drawings of the actual road and its environments were collected. Beyond that, the accident analysis team applied an "on-the-spot" method in the investigations.

As soon as possible after an accident—usually within a few days—the team went to the accident site. Visiting the accident site has two objectives:

- To measure braking and skid marks, and to register the point of collision. The marks on the accident site together with an estimation of the damages of the vehicles involved is important for an estimation of the speed as well as for a reconstruction of the accident. Thus, it is important that inspection of the accident site takes place as soon as possible after the accident.
- To measure, register and take photographs/videos of static conditions (e.g. road markings) from the directions from which the road users approached the site, etc.

Further, the accident site was often "driven through" to test the overview as well as the appropriate speed and the highest possible safe speed.

Often, important factors were revealed when discussing road users' processing of information in relation to the overview of a stretch of road, a curve or an intersection. This possibility of focusing on a larger area was important for the analyses, as police reports and photos often deal only with the immediate scene of the accident.

Experience shows that when visiting the accident site, it is very important that all the fields of expertise are represented (except perhaps the physician) and contribute with their points of view based on their profession. The vehicle inspector can contribute, e.g. with his expertise concerning the direction of motion of the vehicles during the accident as well as a preliminary assessment of the speed based on the brake and skid marks. The road engineer can contribute with his knowledge of the rules of the road markings, knowledge of curve radius, etc. The police officer can contribute with a general knowledge concerning accidents. The psychologist can contribute by focusing on the perception and cognitive aspects in relation to the surroundings and the supposed position of other road users at the time of the accident. In this way, hypotheses can arise, be supported or perhaps be rejected during the discussions at the site of the accident.

2.1.2. Investigation of the vehicles involved

The objectives of the investigations of the involved vehicles are as follows:

- From the damage of the involved vehicles combined with braking and skid marks and point of collision, to estimate the direction of motion of the vehicles before, during and after the collision.
- From the damage of the involved vehicles, combined with braking and skid marks and point of collision, to estimate their speed at the time of collision and the speed before the driver had started breaking.

- To estimate the effect of the safety equipment as well as the safety of the vehicle construction.
- To compare the damage of the vehicles with the injuries of the parties involved.

2.1.3. Interviews

The psychologists interviewed the involved parties and witnesses. The involved parties were asked about:

- Driving experience, local knowledge, driving habits, etc.
- Behaviour before the accident, consumption of alcohol or medicine, sleep, the purpose and length of the trip, speed, etc.
- The traffic situation immediately before, during and after the accident, sight conditions, positions of other road users, perception of own and other road users' speed, perception of other road users' behaviour, evasive actions, injuries, etc.

This information contributed to the later reconstruction of the course of the accident as well as in estimating the effects of passive safety equipment.

The most important part of the interview was inquiring about the information processing during the pre-crash phase—What information was available to the road user? What information did he perceive? How was the information interpreted? What decisions had been made? How did the road user subsequently act? In addition, each interviewed person drew a sketch of the accident site, plotting the road users' positions during the pre-crash, crash and post-crash phases of the accident.

The police officer obtained information of the driver's possible earlier violation records.

Finally, hospital journals were collected regarding injuries of the involved parties, which made it possible to estimate relations to vehicle damages, and the importance of use/lack of use of safety equipment. A forensic laboratory carried out blood analyses from the involved drivers for medicines and drugs if requested by the Road Accident Analysis Group.

2.2. The analysis process

On the basis of the collected data, each member of the team independently of the others carried out an analysis of the course of each of the accidents in a systematic way, i.e. based on a common schedule to make sure that all aspects were considered in each of the analyses. The schedule had as an important part the previously mentioned method used by Swedish accident investigation teams [5]. This approach focus on how the driver perceives and interprets information from other road users as well as from the environment and from his own vehicle. On this basis, he decides how he will drive and acts correspondingly.

To handle a traffic situation in a correct way, that is without any risk, the driver needs the following conditions to be fulfilled:

1. He must have access to the information, which is necessary to understand the situation (important information may for instance be hidden behind an advertisement sign).
2. He must perceive the necessary information (e.g. attention must be directed towards other relevant road users).
3. He must interpret the information in a correct way (e.g. the interpretation of other road users behaviour, the interpretation of the course of a curve).
4. He must take the right decision (e.g. about whether to drive into an intersection or to wait).
5. He must act in the right way (e.g. he must make the right evasive actions).

The information processing is influenced by factors from the road user himself, from the vehicle and from the environment.

In each part of the process, something may fail and accident factors can arise.

It should be mentioned that this model was also applied in relation to the visiting, registrations and discussions at the accident sites as well as in relation to the content of the interviews.

Each team member carried out his own analysis of the accident occurrence with the focus on his own area of expertise, e.g. the road engineer paid special attention to the sharpness of a curve and the road markings related to this, the vehicle inspector made special attention to a worn-down tyre and the importance of this as a possible accident factor. Each analysis ended up with assessing accident factors (i.e. factors which were judged to have contributed to the accident) and injury factors (i.e. factors which were judged to have contributed to the seriousness of the injuries) and with accident prevention proposals.

Accident factors could be related to the road user, the road environment and/or the vehicle and in general more than one accident factor contributed to an accident. However, in accordance with other research findings it was found that most of the accident factors were human factors.

The definition of accident factors was not restricted to acts initiating the accident, such as excessive speed while driving through a curve. The definition also encompassed causal factors behind the acts such as inexperience, drowsiness or conscious risk taking. It is important to include such factors if one wants to get a deeper understanding of the accident causation and consequently be able to define relevant preventive measures as precisely as possible.

The analysis reports from the group members were discussed at meetings and a final report for each accident was written supplemented by a time and space diagram, where the road users' positions were plotted in second by second. Finally, a public report was written summarising all the accidents in a none recognisable way, and with the findings and proposals for preventive measures related to the accidents.

3. Results

In the following some results from the analyses of four different accident types will be summarised. The numbers in the brackets state how often the accident factor appears. Regarding injury factors, the most prevalent was the failure to wear a seat-belt. As no other injury factors were common, only seat-belts will be mentioned in the following.

Typically, the accidents occurred as a combination of several accident factors of which most were human factors.

3.1. Head-on collisions

3.1.1. Human factors

The main accident factors in the 17 analysed head-on collisions were excessive speed (eight), drunk driving and driving under the influence of illegal drugs (five and four, respectively). An example from the category of excessive speed is a driver who lost control of his vehicle when driving with excessive speed into a curve. Besides, he was influenced by drugs, he was angry and was drinking during the driving, and in a later interview some of his friends told that he had shown a very aggressive behaviour even before he started the trip.

The prevalence of alcohol (five) and drugs (four) were in some accidents seen in combination (two). Driving under the influence of alcohol or drugs often resulted in reckless driving and in the drivers' underestimating difficult driving situations or overestimating their own ability to handle these situations; it also caused drowsiness and inattention.

Improper evasive actions (three) were seen as a consequence of sudden steering actions, which brought the right wheels of the vehicle out into the verge. In an attempt to drive back on to the paved road, the driver skidded into the oncoming traffic.

3.1.2. Road and vehicle related accident factors

Road related accident factors were found to be relevant in only one accident, where a driver had overseen road markings indicating a lane change (connected to roadwork) and drove through the markings into the opposite lane. The distance between the road markings were correct according to the standards but left very little room to take evasive action once one had driven into the area. Moreover, one vehicle related factor was found in the analyses. The tyre exploded and the driver lost control of the vehicle, which then drove over into the opposite lane.

3.1.3. Injury factors

The primary injury factor was the occupants' failure to wear seat-belts. In regards to the fatalities, the respective vehicles were found to have received so much damage that the outcome would have been the same, no matter whether seat-belts were worn or not. In most other cases injuries would have been minimised if the occupants' had worn seat-belts [7].

3.2. Accidents with left-turning vehicles

3.2.1. Human factors

The primary accident factors for the 17 left-turning drivers were attention errors (11–13) or misjudging the amount of time they had to complete their left-turn (1–2). Moreover, elderly people were over represented (seven of the drivers who caused or contributed to the accident were more than 65 years old), which is also reflected in the national statistics for accidents occurring at intersections.

None of the drivers misunderstood their duty to give way to approaching traffic and none were judged to have driven forward recklessly, knowing that there was little time before the approaching traffic reached the intersection.

When accident factors were linked to drivers travelling straight ahead, the problem was either excessive speed (three–four) or inattention (three).

3.2.2. Road and vehicle related accident factors

Of the 17 analysed accidents, three–five were judged to have road or road environment as contributing factors. In particular, an uneven view of a junction was a major factor.

No vehicle related accident factors were found in this accident type.

3.2.3. Injury factors

Only two of the drivers, to whom the accident factors were related, were not wearing seat-belts. According to statistics, there are few left-turning drivers involved in accidents that do not wear seat-belts, which supposedly reflects the fact that these types of accidents result from human error rather than conscious risk taking. Three of the counterparts and five passengers did not wear a seat-belt. In most cases, injuries were judged to have been minimised due to the occupants wearing seat-belt [9].

3.3. Truck accidents

3.3.1. Human factors

Insufficient searching for visual information played an important role in a large number of the 21 analysed truck accidents for the truck driver himself (seven) as well as for the counterparts (nine). Speeding was a contributing factor, which was more often found among truck drivers than among their counterparts (eight and two, respectively), whereas low age and inexperience were mainly found in relation to the counterparts.

It could not be concluded from the analyses that truck drivers are poorer drivers or make more mistakes in traffic than their counterparts; to estimate this, it would call for a much larger study. But when truck drivers are speeding or make mistakes, the results in many cases will be more

serious due to the weight, form, manoeuvring abilities, breaking abilities, etc. of the trucks.

3.3.2. Road and vehicle related accident factors

The road related accident factors were primarily bad sight conditions (six) or bad weather/road state due to the weather (five).

Vehicle related accident factors were for the trucks in two occasions seriously damaged tyres which exploded.

3.3.3. Injury factors

None of the truck drivers had used a seat-belt and only in a single case, seat-belt wearing would have reduced the injuries of the truck drivers. Six car drivers and passengers did not use a seat-belt, and in four of these cases, the seat-belt would probably have had a positive effect [10].

3.4. Single vehicle accidents

3.4.1. Human factors

The most frequent accident factors in the single vehicle accidents were speeding (22), negligence (17 occasions) and drunk or drugged driving (13 and 4, respectively). The accident factors were often combined. E.g., negligence was due to the influence of alcohol (in seven)—a known cause for reduced attention and reaction or to passengers distracting the driver because of high spirits in the car (four).

In 12 occasions, risky driving were an accident factor primarily connected to playing, fun or testing the car or one's own skills.

3.4.2. Road and vehicle related accident factors

When the road or the surroundings proved to be the accident factor (21), one or more road user related accident factors were involved in each one. Reduced friction (nine) and the roadside design (six) were the frequent accident factors. A soft verge or a decrease away from the paved road prevented drivers, who for some reason came into the verge, from immediately manoeuvring the vehicle back on the paved road again, and they handled the situation in an inappropriate way.

In five accidents one or more accident factors were related directly or indirectly to the vehicle, and in all cases the speed limit was exceeded. The accident factors were for instance a motor, which was too powerful in relation to the weight of the car or a worn-down tyre.

3.4.3. Injury factors

Two-third of the involved drivers and passengers did not wear a seat-belt. Ten out of 13 people killed did not use a seat-belt, and estimates suggest that eight out of the 10 would have survived the accident if they used a seat-belt [11].

3.5. Evaluation

Due to the multidisciplinary approach and the extensive data collection, the in-depth analysis of the accidents have provided a more detailed picture of the accident occurrence and a larger and more precise knowledge of the factors behind than feasible by other methods such as national statistics or analyses based on police reports. The extensive data collection implies that an accident has been exposed from several different approaches and the contributory role of the road user, the vehicle and the environment and their interaction could be assessed. New aspects have appeared which have often had decisive influence on the determination of accident factors and conclusions. Specific aspects arose that could be supported or rejected by national statistics and which have, therefore, contributed to a clearer picture of some of the characteristics of the accident type in question. Furthermore, the broader data foundation might contribute to disproving accident factors, which could otherwise have seemed plausible.

The method lays the basis for more valid suggestions towards preventive measures than otherwise possible, just as it can provide a basis for pointing out more targeted future research.

No other method provides such extensive information regarding the road user, the vehicle and the environment and their interaction in relation to the accident. National official statistics provides more general information, such as the development in the total accident picture as well as in more specific road accidents, and they can illuminate a number of isolated circumstances connected to the accidents, e.g. time of day, type of road, drunk driving, etc. They are however entirely based on information from police reported accidents, and this information is simplified and standardised [6]. They cannot tell about the occurrence of the accident including identifying the behaviour of the involved parties or the behaviour that resulted in the accident, and as such they can neither identify all accident factors nor identify eventual combinations of accident factors. Thus, it may be difficult to deduce precisely which preventive measures will be suitable in relation to the specific type of accident.

One way to obtain more knowledge about the dynamics in specific accident types is to carry out analyses based on police reports. This is a much less expensive method than carrying out in-depth analyses. This method however has limitations as well. The purpose of the police is to assess who is the guilty part or parties, and when this is established, which may be on the basis of rather little information, they stop their investigations. Moreover, in accidents with slightly injured the information from the police reports are often very limited. In the in-depth analyses work, the accident investigation group sometimes found that the information from the police reports was quite insufficient and inaccurate.

In comparison with accident analyses based on police reports alone, the in-depth analysis methodology provides a better opportunity for observing possible unknown accident factors in at least six areas:

- Investigation of accident sites shortly after the accident provides the possibility of finding and measuring various

traces from the accident, which can shed light onto the motorists' behaviour before the collision.

- Inspections of all vehicle damages combined with breaking and skid marks and point of collision makes estimations of the direction of motion of the vehicles as well as of their speed possible. Moreover, the effect of the safety equipment can be estimated and the damage of the vehicles can be compared with the injuries of the involved parties.
- Interviews with the involved parties and witnesses give a more detailed knowledge of their behaviour before the accident as well as in relation to the different phases of the accident itself. This among other things is due to the fact that the interviews are treated confidentially and no information is passed to the police.
- The medical evaluation of injuries in relation to damage to the vehicles is an invaluable contribution in respects to the role of passive safety equipment.
- Analysis of blood tests for traces of narcotics or medicine played an essential role in determining accident factors.
- As regarding accidents with slightly injured, the extensive supplementary data collection will be able to compensate for the often very sparse information in the police reports from such accidents.

However, experience has shown that a number of pre-conditions must be present to make the in-depth analyses function in an optimal way. Some of these are discussed below.

3.5.1. Continuity and experience

Continuity of the members of the multidisciplinary team is important, as the in-depth method requires a certain amount of training and experience. Continuity improves the synergy effect of working as a multidisciplinary team at accident sites as well as it improves the quality of the analyses.

None of the involved specialists had worked with in-depth analysis before. They all brought to the group their specific knowledge, which of course, was considerably attached to their own area of expertise. However through the multidisciplinary co-operation, the joint inspections, the joint analysis work and all the discussions in the group during the work, each member gained and became able to use a much broader knowledge concerning accident factors. They were no longer just focusing on possible accident factors related to their own area of expertise, but were able to use a much more multi-faceted perspective than previously. Thus, it was the estimation from all the group members that continuity and experience in the group provided the most qualified results.

3.5.2. Priority of the work

It is very important that each team member is allowed sufficient time in such a way that he is able to fulfil his function in the team, whenever it is necessary and without any delay. Otherwise the quality of the work will be reduced as it may result in postponing of or insufficient participation in inspections at the accident site, insufficient investigations of the vehicles involved, insufficient participation in meetings, etc. with the consequence that the specific advantages in the in-depth investigation work will be reduced.

3.5.3. Confidentiality

A guarantee that involved parties' information during the interview is treated confidentially, and in no way will influence potential future settlements from insurance companies or from the police is necessary.

Thus, as mentioned above the strength of the in-depth analyses are that they can make factors appear, which do not appear from other methods. They can discover possible typical accident factors and provide a basis for hypotheses, which can be further investigated in other ways.

One limitation in relation to the in-depth analyses is that due to the great demand of resources, only a limited number of accidents can be analysed. Thus, without further evidence the results cannot be generalised to other similar accidents. Though rejection or support of some of the results may be found by studying the national statistics, this is not always possible. For instance, a tendency found in the analyses of head-on collisions that drivers, who collided with traffic in the opposite lane were men and the majority were under the age of 40 could be confirmed through the national statistics. Conversely, the finding of drivers influenced by illegal drugs cannot be illuminated through the existing national statistics but must be investigated further through other research methods. In fact, the results from the analysis of the head-on collisions pointing at four out of the 17 active drivers had taken narcotics or medicine to a degree that it was judged to be an accident factor was part of the basis for a decision from the authorities to initiate further research in this area.

Finally, it should be mentioned that the in-depth accident analysis method requires a lot of resources, and will probably be too expensive and time-consuming to apply to all road accidents. However, the method is suitable for analyses of common occurring or very serious types of accidents or in other cases, where for specific reasons it is found valuable.

No cost–benefit analysis has been carried out. Making such an analysis on the costs and the results is difficult, and seems to be of limited interest. The main thing is whether the in-depth analysis method provides valuable, relevant and usable results that cannot be obtained in any other way. This has been confirmed through the present studies.

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