Smart Approach to Documenting and Identifying the Culprits of Minor Traffic Accidents

Abstract
The paper deals with the concept of a new information system that is proposed for automatized documentation of traffic accidents and subsequent determination of guilty or degree of fault of participants in minor traffic accidents. Initial part describes current methods for determining the degree of fault in traffic accidents. Special stress is given to "minor accidents", in which the damage level of each vehicle does not exceed CZK 100 thousand, and where is neither property damage of other subjects nor injury of any person. They are also indicated weaknesses of current method of determining the culprits of minor traffic accidents and possible negative consequences of current practices. Published data enable to estimate number of accidents which are not investigated by the police. Based on analysis of shortcomings of existing procedures is proposed new technological solution "crash terminal", allowing objective documentation of the situation immediately after the minor accident. The basis of the device, which is described by a block diagram, is a mobile phone that is equipped with positioning system, a camera with integrated distance measurement and a digital compass. The description of technological solution is followed by a design of process solution, based on existing legislation and the status of "traffic arbitrator" to determine the culprit of an accident. Final part indicates some economic context of the proposed system and possibilities of its application. The paper illustrates unprecedented advantage of the proposed system for participants of minor accidents, as well as institutions dealing with the liquidation of consequences of such accidents - i.e. primarily for commercial insurances. A model example demonstrates very fast return of investments thanks to the practical avoiding of faked insured events.

Key Words
crash terminal, traffic accidents, information system, communication, insurance, fraud, accident investigation, record of the accident, traffic arbitrator, fault

JEL Classification: A12, K42, L91, L96, O31

Introduction
Once upon a time... On a busy crossroad of a satellite city collide two cars driven by young mothers, which are taking their children to kindergarten. Nobody is visibly injured, cars have just creased fenders. Crashed cars significantly reduce traffic, it forms a long column, drivers honking, children in cars heartrending cry... Both lady drivers call the police. Operations officer - after making sure that no one was injured - advise to solve the matter alone... After urgent pleas of one lady driver, that has two crying children in the car and is obviously in shock, reluctantly promised that the police will come, but due to momentary
possibilities no earlier than in two hours... After fifteen minutes of helplessness and humiliation, the two young women embark on a documentation of the accident. One driver draws up on a piece of paper a kind of declaration that the other driver acknowledges guilt and that the shame on both cars is about 80,000 CZK. The second driver refuses own blame, but her children are continuously crying and thus she ultimately signs her guilty in order to already had a peace from that hell. Both damaged cars leaving...

The second day after the accident informs the insurance company the lady driver who allegedly caused the accident that the total cost of repairing damaged vehicles greatly exceeds the amount of 100 thousand CZK. Due to the fact that the accident was not investigated by the police, insurance company refuses bear the costs of repair under insurance contracts. The third day after the accident one of the children of the car, whose driver wheeled on the second one the conviction, reflects the severe nausea and fainting. Child in spite of a quick transport to a hospital dies. An autopsy shows bleeding in the brain due to strike to the head about three days ago...[2]

This story is a fiction but under current legislation and procedures it is not far away from the situation that could occur... We feel the necessity to reduce danger of similar situations as mentioned above. Following paragraphs suggest possible technical and procedural solution.

1. Current methods of assessing the traffic accidents

The birth of massive road transport has brought a new negative phenomenon – traffic accidents. In this context arose the social demand for legal form for compensation of damages on vehicle whose driver did not cause the accident, reimbursement of costs associated with the treatment of persons injured in traffic accidents and compensation for damage to property of foreign persons and entities [5]. This situation is solved in most countries in the form of legal compulsory insurance. In the following paragraphs we will deal with the so-called minor accidents, i.e., one that do not result personal injury (although this issue is not simple – see above) or damage to property [6].

Investigation of traffic accidents – especially the degree of their fault – was from the beginning the task of the traffic police. Police – also due to reducing the number of policemen – cannot handle all traffic accidents. The vast majority of accidents – even thanks to the growing of vehicle safety – without injury end with a “mere” creasing plate. Many of these “minor” accidents have a clear culprit, who should be able to ascertain by the participants of an accident themselves [1, 4].

The numbers of vehicles are in recent years constantly increasing. One might therefore expect that inevitably must increase the number of traffic accidents. From Figure 1, it is evident that the beginning of the past decade can be characterized by a relatively stable indicator of the number of traffic accidents. This trend continued until 2008. The most critical year was 2005 with 199,262 accidents. The dramatic decline in the number of traffic accidents is evident between 2008 and 2009. This jump was caused by a change in legislation, which involves the obligation to report the accident to the Police only in cases of
personal injury, death, third party property damage, material damage higher than 100,000 CZK for one vehicle [10]. (Note: In 2000, the limit for the notification of traffic accidents was just 1000 CZK. Since January 2001, a law significantly increased, to 50,000 CZK).

**Fig. 1 Development of traffic accidents in the Czech Republic in 1999 – 2012**

[Graph image]


In other cases it is not necessary to inform the police of the traffic accident. The assessment of the accident cause is determined by the agreement of drivers involved in the accident. Based on these facts can be concluded that accidents have not diminished, but are fewer reported and placed in police statistics [4].

Following a change in legislation, the number of traffic accidents has stabilized at around 75,000 per calendar year. It can be assumed, however, that the curve of accidents still continues in the same trend, with the difference that more than half of traffic accidents are not recorded by the Police. Damage of vehicles involved in an accident must be paid by the insurance company of the culprit of an accident. This gives a space for various insurance frauds. They happen quite often and without an objective investigation of the Police are very difficult to prove. The total amount of insurance fraud proven value increased significantly in 2011 to CZK 838 million that representing an increase of a massive 34 % [11]. The largest number of insurance fraud was traditionally revealed in the vehicle insurance. Insurance companies examined in this field by 47 % of suspected cases more than in previous period.

This form of dealing with traffic accidents may have a number of negative consequences. Any driver after a traffic crash is under stress is not able to objectively assess the situation. He is often driven by his efforts to end the unpleasant situation as quickly as possible – especially if his vehicle is blocking traffic or if he is in the time pressure. There are known cases where some insurance companies challenged the results of driver’s agreement and refused to reimburse the costs associated with the repair of the vehicle. The real problems may arise in the case of real or fake health consequences as a result of a traffic accident or during subsequent legal disputes to determine the degree of fault.

In next paragraphs will be described the technology for objective documentation of accident situations.
2. The smart technology – Crash-terminal

Crash-terminal is an electronic device that enables faster, more accurate and more convenient to investigate minor traffic accidents. Manipulating the terminal should not be more complicated than handling electronic equipment such as mobile phone or digital camera [2].

Prerequisite remains certain minimum level of technical competence of car drivers, which nowadays grows together with the ever-expanding range of electronic equipment to facilitate the daily living needs. Individual crash-terminals can be used to capture the state immediately after a traffic accident in the clear defined assumptions when there is no obligation to call the police. Crash-terminals acquire specific information about the location of an accident, including information about the driver and the vehicle.

The basis of Crash-terminal is a mobile phone equipped with a digital camera. Other integral parts of the Crash-terminal are positioning system, a distance measuring system and the system for determination of direction of the lens when taking photos. Crash-terminal enables capturing, processing, storing and shipping data, which is based on photos taken from Crash-terminal, and which are supplemented by data of the position of Crash-terminal, data defining the direction of the lens when taking a photo, and data describing the distance of the object that the mobile crash-terminal photographed. The main benefit of the system lies in the acquisition and processing of objective data of the state after a traffic accident, allowing incorporation into the digital data (GIS) corresponding relevant section of roads [9].

In principle, the role of Crash-terminal could after minor modifications of SW fulfill number of powerful smartphones equipped with the Android operating system. Smart Tools (as a free application of e.g. Samsung GT-S5360 Galaxy Y) is able to mediate majority of data necessary for identification of after-accident state. The price of dedicated a special device, however, in the case of mass production could reach a level of CZK 1,000.

Use of the automated system of records and documentation of accident-states via Crash-terminal itself would significantly simplify the settling potential disputes, to ensure the possibility of expert assessment of the degree of fault by traffic accidents by their individual participants and significantly reduce the possibility of insurance frauds. The use of the Crash-terminal would allow significantly alter the situation described in the introductory chapter. The scenario could be as follows: One of the damaged cars drivers is taking out of car storage modified mobile phone – the “Crash-terminal” – which she has received from the insurance company when signing the contract on the lawful insurance. Integrated camera takes pictures of accident – wrecked cars, damaged parts of vehicles. Photos, complemented by geographic coordinates of the location of the accident (i.e. position Crash-terminal when shooting), direction, angle and distance of the subject in the form of MMS are automatically sent to a central dispatching.

There is automatically generated in the GIS map with the accident situation and is stored in the database. MMS is complemented with textual information entered into prepared form, which provides the basic attributes of an accident – driving directions of vehicles, etc.
In the case of our lady driver the database stored and archived the documentation of the immediate status after a traffic accident, which may be in the event of a judicial proceeding used as a burden document in terms of identifying the culprit of the accident [9].

3. The evaluation and decision making process

The proposed technical solution is “only” a significant part of a broader evaluation system for minor accidents – see Fig. 3. On the picture are described individual entities and procedures of decision making process. However, this procedure is based on the legislation in force and can be only applied when no one in an accident is injured and there is no damage to property of others. At the same time, all participants of the accident must estimate that the amount of damage to their vehicle does not exceed 100 000 CZK. In such case any of the parties involved in a traffic accident documents the situation by a Crash-terminal. He makes pictures documenting the location of vehicles after the accident. At the same time takes pictures with corrupted parts of vehicles. Digital data of snapshots are supplemented with geographical coordinates of the accident based on GPS or Galileo positioning system (respectively coordinates of the camera at the time of shooting) and distances between the subject and the camera. It is also necessary to take pictures of license plates that uniquely identify participants of an accident.

Automatically recorded data must be supplemented by identification of drivers (number of driving license or other identity card) and – for some examples – description of a journey (from – to). This information in the MMS format is sent to the operation center. Traffic arbitrator receives the Crash-terminal data complemented with appropriate data from a GIS. Traffic arbitrator is a responsible person certified for assessment of controversial traffic situations. On the basis of an expert assessment of the situation gives his judgment. It is through the Operations Center via SMS delivered to the participants of the accident. The information is currently stored in the operations center and the data packet “Accident Report with Judgment” is send to appropriate insurance company to realize the compensation for damage.
Naturally, it may happen that any of the parties involved in a traffic accident does not agree with judgment of traffic arbitrator. In such case is necessary to call the police, that the situation on the site evaluate and issue a final decision. This decision has a higher legal force than a statement of the traffic arbitrator.

The proposed system in this way complements the Czech legislation on the status of traffic arbitrators. Currently some insurance companies in the Czech Republic unlawfully assessed the degree of culpability of traffic accidents. By law, they have the right to assess the extent of damage only, not the degree of responsibility. It falls exclusively within the competence of the police and judiciary. The establishment of the statute of the traffic arbitrator could insurance companies part of these competencies appropriated. Insertion of a clause arbitrator in insurance contracts can establish that in traffic accident participants are required to cooperate with the operating center [1, 5, 10]. The great advantage of new system is, that in the case of legal disputes is available unquestionable documentation of the accident.

4. The economic assessment of proposed procedure

Although perhaps the most important attribute of the system is to improve legal certainty and confidence in the fair dispute resolution resting on professional expertises, important argument is well taken legally relevant documents from accident site to avoid even at any subsequent disputes to lack of items of evidence (see potential situations in the introductory chapter). Within the design of the new system were also solved through economic models some financial issues associated with its implementation. The work on different models is currently in progress. Therefore, here are suggested only some applied starting points. Total system expenditure can be divided into two main parts: 1) costs associated with acquisition of crash-terminals, 2) the cost of setting up and services of the operations center, including remuneration of the traffic arbitrators.
In terms of implementation can be take into consideration two variants – a) disposable large-scale deployment of terminals in all motor vehicles; b) gradual introduction of terminals in new vehicles. The cost of dedicated terminals is estimate between 500 – 1000 CZK. In 2012 the Czech Republic had registered 6,463,232 motor vehicles with an average vehicle age 16 years. It is clear that the waiting for the gradual acquisition of new vehicles equipped with crash-terminals is due to time reasons unacceptable. Price of CZK 6 billion looks menacing, but at least in the initial phase is not necessary to equipped with terminals motorcycles and tractors (about 1.1 million of vehicles). Acquisition of terminals may be once included in the cost of mandatory insurance.

The entire system must be financially independent. The most important item of operating expenses are costs of professional expertise. In 2012, it was resolved approximately 380,000 claims relating to traffic accidents. In the police statistics were recorded about 80,000 traffic accidents, i.e. insurance events investigated by the police of the Czech Republic. Starting from these data we can consider approximately 300,000 accidents that should be solved by traffic arbitrators. If we estimate the average time for an expertise to 10 minutes, we can quantify the minimum annual man-hours of expert services to 50,000 (300 000 : 6). When considering annual working capacity of an expert to 1500 hours, we need for this activity at least 34 operators (traffic experts). In order to have a sufficient reserve with respect to the uneven distribution of accidents over time, count model with the need to double the number of experts (ie 70). Assuming the monthly payroll costs of an expert to about 35 thousand CZK, annual labor costs of experts is less than CZK 30 million. Should it become necessary to deal with about one third insurance events by external experts and one expert price would amount to CZK 300, the cost of external expertise should also reached CZK 30 million. With a large reserve can be estimated operating cost of the system (including operating costs of ICT) to 70 million CZK. If the service price of traffic expert would be established for the culprit of the accident on the 500 CZK (which is considerably much less than the penalty for an accident investigation by traffic police), estimated income is approx. 75 million CZK, i.e. higher than the operating costs of the system.

**Conclusion**

The proposed system will also significantly reduce insurance fraud. Based on model estimates of 2.5 % savings due never realized insurance frauds, benefits of the system for insurance companies would be annually around CZK 0.3 billion [13]. In the near future we are going to elaborate financial aspects of the proposed system in details.

**References**


