VERIFYING A TRUCK COLLISION APPLYING THE SDC METHOD

Piotr ALEKSANDROWICZ[1]

[1]*Faculty of Mechanical Engineering, Institute of the Automation and Transport, University of Science and Technology in Bydgoszcz, Al. prof. S. Kaliskiego 7, Poland.*

Abstract
A car collision with a barrier or with another vehicle results in a necessity of repair and the costs are usually not low at all. It causes problems of abuse by reporting fake car collisions. The research methods presented in the article applying computer methods executed with the SDC method facilitate an efficient verification of car collisions which, in fact, did not occur. Research methods executed in the SDC convention use the static, dynamic analysis of vehicle damage as well as the analysis of characteristic damage. To automate the decision-making process during the crash verification with the SDC method, the author's IT tool to be applied in practise was also developed. The research with a set of real road traffic damage already at the stage of civil-law proceedings shows that insurance companies face a problem of a lack of effective computer methods which would allow for eliminating fake vehicle collisions.

Key words: *SDC method, vehicle collision verifying.*

INTRODUCTION

The repair costs, to be borne to restore the vehicle to its before-accident condition, are the cause of fake car collisions. Insurance companies see the problem of insurance crime, however, to manage claims, they do not introduce any computer methods applied in mechanical engineering in a form of simulation programs for vehicle collisions, databases of vehicle vector styling and IT tools aiding the decision-making process.

The possibilities of applying the proposed method to eliminate insurance frauds have been described in another paper (*Aleksandrowicz, 2017a*), and verifying vehicle collision with the SDC method requires dividing the process into three groups of computer research methods.

The first group includes a static analysis of damage inflicted during the collision of vehicles (S). The aim of applying the proposed procedures in that group is verifying the geometrical agreement of the damage of vehicles involved in the declared collision. The procedure uses the databases of vehicle vector stylings and their photographs (*http://www.autoview.at*).

The second group of research methods uses IT tools for a dynamic analysis of collisions and its aim is to verify whether such collision could have occurred in the circumstances reported. The analysis involves both verifying the vehicle crash itself and time and space relations between the participants of the collision reported to the insurance company. Dynamic analysis uses simulation programs offering a selection, adequate to the damage verified, of model and parameters of the crash and collision detection model as well as computations to determine whether time and space relations necessary for the contact between the simulation objects exist. Another paper (*Aleksandrowicz, 2017b*) discusses a selection of the applicable model of vehicle collision and collision detection while working with V-SIM4 program (*V-SIM4.0 – User manual, 2016*) used for a dynamic verification of vehicle collisions with the SDC method, whereas papers (*Kostek, 2017a,b et al.*) cover identifying impact parameters based on crash tests and a simulation of vehicle collision with a barrier to be applied in V-SIM4 program by road accident reconstruction and claims verification practitioners. Using software for a dynamic analysis, one should also consider an effect of uncertainty of the input data on computation results. With that in mind, it is most effective to use the modules of simulation programs which facilitate optimization calculations, e.g. with the Monte Carlo method, which has been covered in other papers (*Wach & Unarski, 2007a,b*).

The third, and the last, group of research methods includes an analysis of damage characteristic at the place of contact of vehicles during the crash or collision with a e.g. elements of roads infrastructure. Additionally, to provide a more detailed pattern of verifying the collision with the SDC method and the operation of the dedicated IT tool aiding the decision-making process

(*http://wim.utp.edu.pl/dok/wyklady/analiza_sdc.xlsm*), a demonstration film was recorded (*https://www.youtube.com/watch?v=91rYSnVrbs4&feature=youtu.be*).
This paper aims at demonstrating the SDC method developed to verify vehicle crashes and the author's IT tool facilitating a decision-making process to identify and to eliminate post-accident repair claim frauds.

MATERIALS AND METHODS

For the purpose of this paper, vehicle collisions were examined for 84 claims applying the following SDC method procedures. Further analyses involved the use of the computer program developed by the author; the program automates the decision-making process to eliminate post-accident repair claim frauds.
Static analysis can use research methods which compare real objects in a form of vehicles or their elements, photographs of damaged vehicles or vehicle vector stylings. Performing a transparent superposition involves superposing scaled photographs of both vehicles; one which is less transparent, which allows for a geometrical comparison of damage as in real-life objects, Fig. 1.
Vehicle vector stylings, on the other hand, are imported to the simulation program in the real scale and proportions and their shapes are the shapes of vehicles taking part in the collision reported; they can be used to perform geometrical measurements of the damage zones overlap, Fig. 2.

Fig. 1 Combinations of research procedures in the block of static analysis of the vehicles collision, transparent superposition.

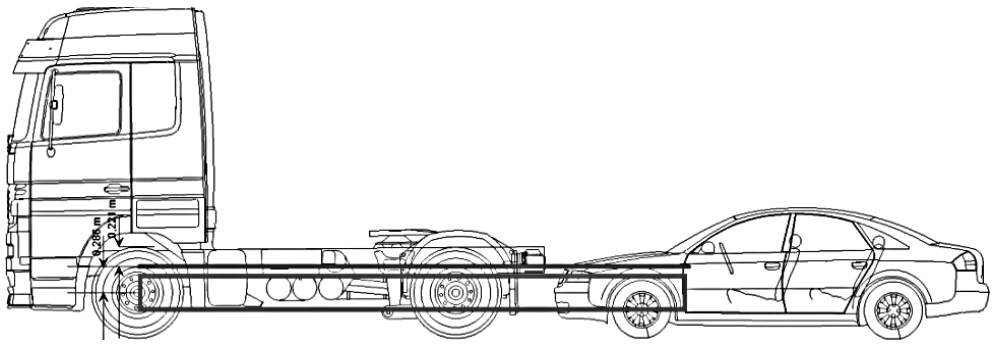

Fig. 2 Combinations of research procedures in the block of static analysis of the vehicles collision a comparison of damage zones in vehicle vector stylings.

Figures 3 and 4 demonstrate the results of the dynamic verification of a truck collision with a passenger car as well as with a tree (*https://www.youtube.com/watch?v=91rYSnVrbs4&feature=youtu.be*).

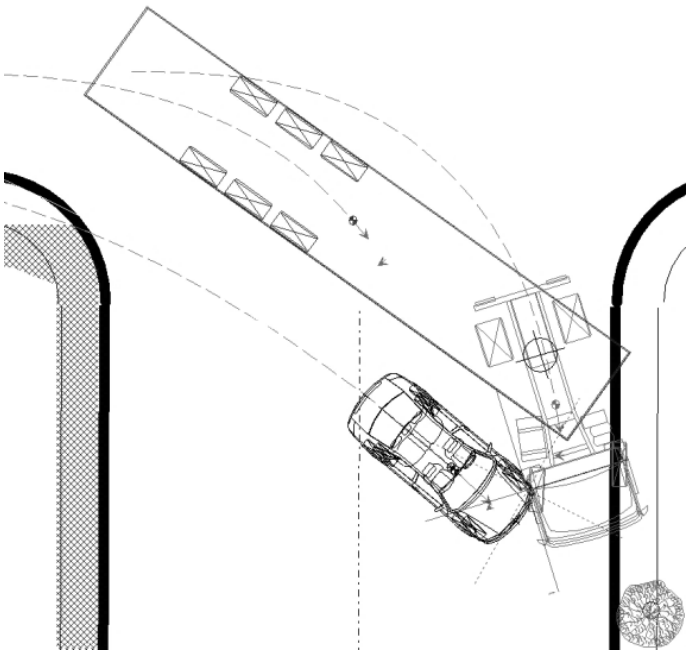

Fig. 3 Visualisation of dynamic verification performed in V-SIM4, a collision between a passenger car and a truck.

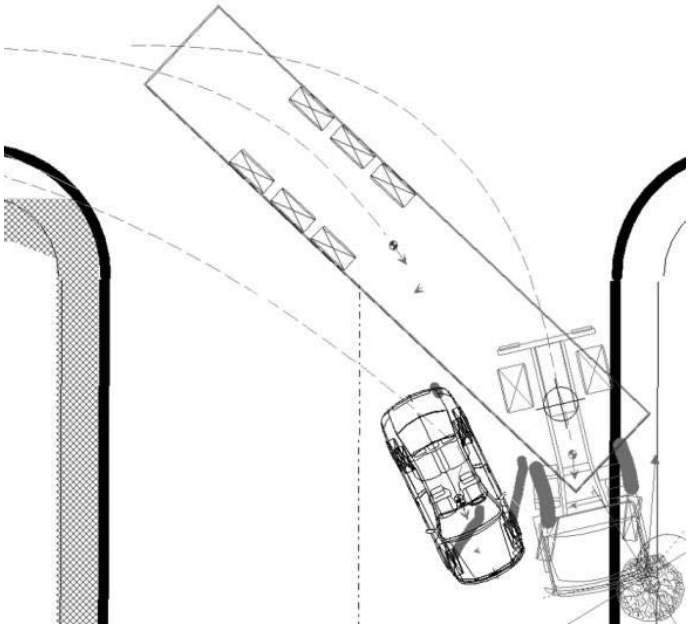

Fig. 4 Visualisation of dynamic verification performed in V-SIM4, a crash of a truck into the tree.

To verify characteristic damage of vehicles, data from inspections of vehicles or photographs taken at the resolution allowing for multiple magnification are used. The analysis aims at identifying the marks of contact between the vehicles in a form of shape mapping, paint layers, organic substances, etc.
Fig. 5a presents a sample mark of shape mapping of a truck hub cap on the passenger car fender as well as paint layers the colour of which correspond to the colour of that hub cap. Fig. 5b demonstrates traces of organic substance (bark) blocked in deformed, after the crash into a tree, structures of the left corner of road tractor cabin.

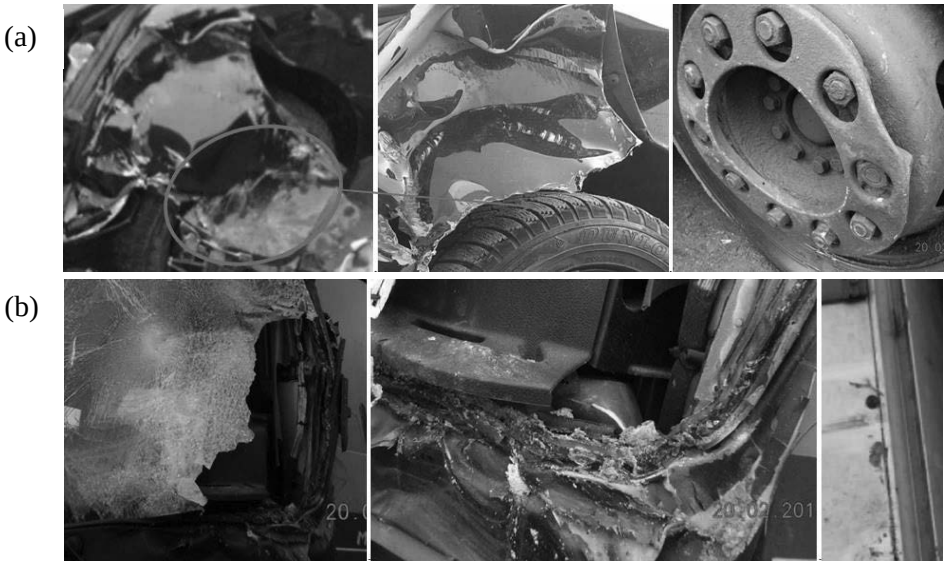

Fig. 5 Characteristic damage in a form of truck hub cap shape mapping on the passenger car fender and paint layers from that hub cap (a) and bark identified in the road tractor cabin (b).

In order to improve the research methods effectiveness, an IT tool has been elaborated to provide decision variants after entering the results of procedures S, D, C of a damage verified. Fig. 6 and Fig. 7 demonstrate the program dialog boxes (*http://wim.utp.edu.pl/dok/wyklady/analiza_sdc.xlsm*).

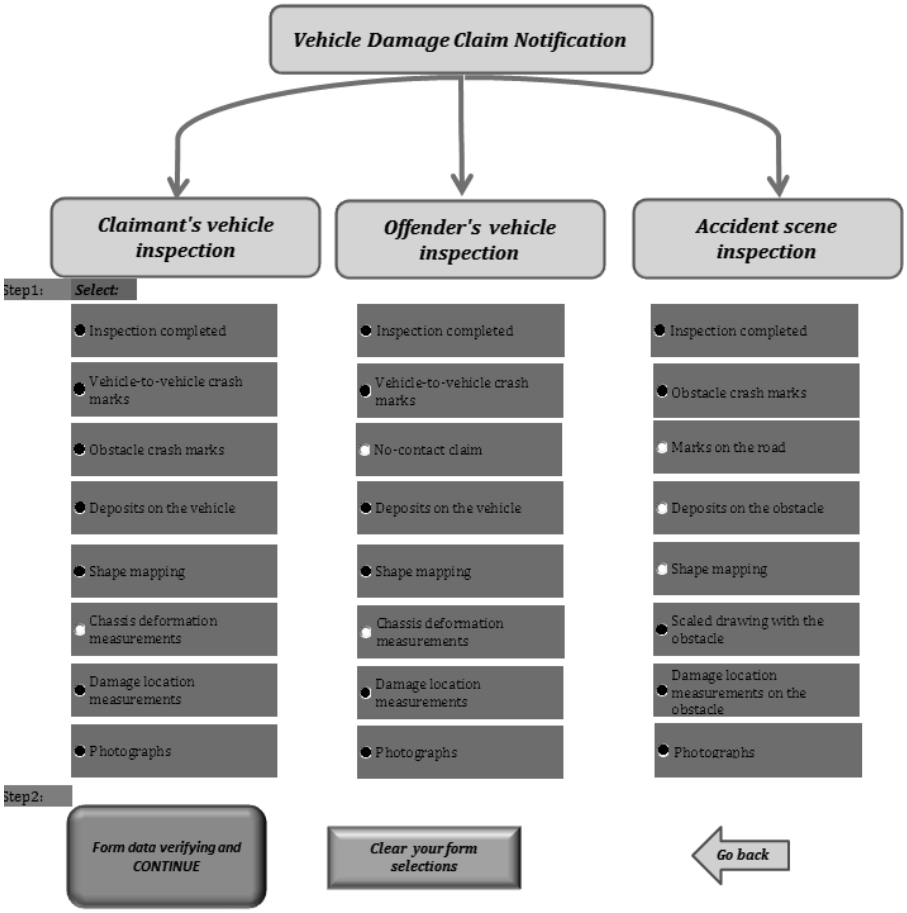

Fig. 6 Entering the input data in the dialog box.

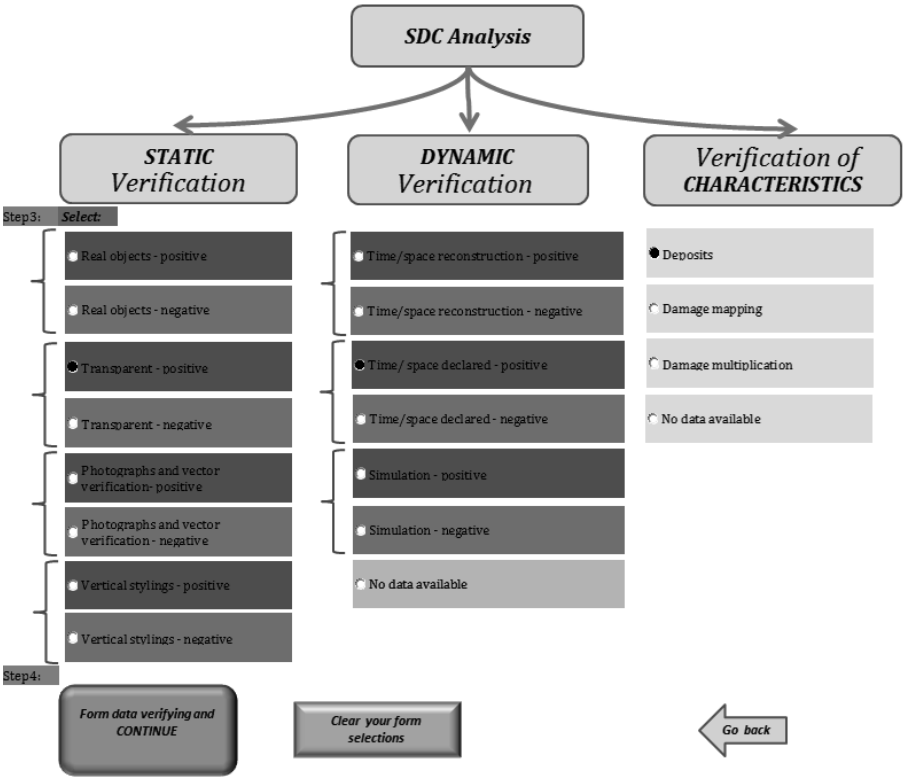

Fig. 7 Entering procedures S, D, C results in the dialog box.

RESULTS AND DISCUSSION

The research covered 84 claims of vehicle damage where the insurance companies refused to pay damages and the damages were claimed in court proceedings. To verify the decision of the insurance company in each case, the SDC method was applied. The analysis was performed applying procedure S, D, C and data was entered into the program to support decision-making. Letters P and N, positive or negative, stand for the result of each procedure, as compared with the total result received with the SDC method, for the results, see Fig. 8

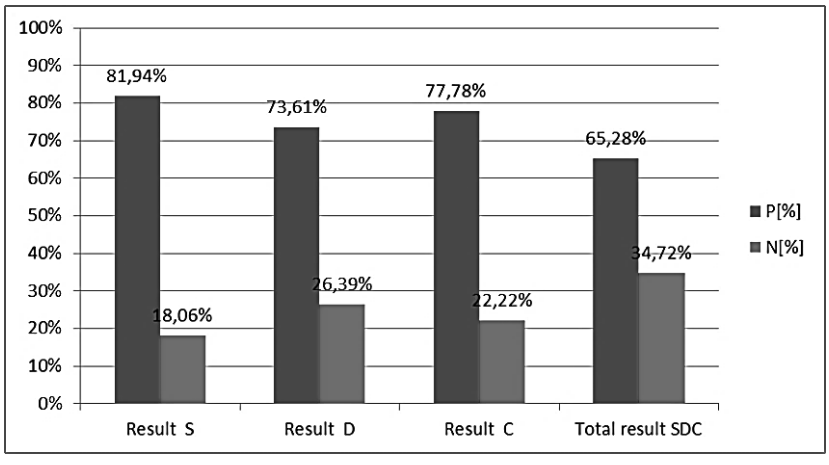

Fig. 8 Results of the study applying the SDC method.

The results of the examination with the SDC method have shown that only 34.72 % of the claims were correctly verified by insurance companies, and payment for the other 65.28 % should have been made already at the stage of claims management, without court proceedings.

CONCLUSIONS

Motor insurance crime is a very important social problem. For example, the issue of motor insurance frauds, as compared with the situation in the Czech Republic and in Germany, is presented in another paper (*Rábek, 2013*). However, in practice, a comprehensive claims verification such as in the proposed SDC convention together with decision-making process automation to eliminate fake collisions does not occur.

Bearing that in mind, it is the author's intention to encourage the application of such new approach in the SDC convention to verify car collisions using the program developed for that purpose to automate the decision-making process. The program offers decision variants to the operator and it has been specially developed following the MS Excel standard described in another paper (*Walkenbach, 2014*), thanks to which it can be applied by a high number of users with that popular software package.

The verification results point to serious problems of insurance companies verifying frauded damage claims both at the claims management stage and at the stage of disputes settled by the court, whichgenerates unquestionable losses for the parties to the proceedings.

Verifying claims with the proposed SDC method and the program developed to aid decision making is a new research, development and improvement area.

It is the author's intention to demonstrate the results of further research in successive articles.

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Corresponding author:
Ing. Piotr Aleksandrowicz, Ph.D., Machine Maintenance Department, Institute of the Automation and Transport, University of Science and Technology, Al. prof. S. Kaliskiego 7, 85-796, Bydgoszcz, Poland, phone: +48 52 3408242, e-mail: p.aleksandrowicz@utp.edu.pl