

To the core of road crash causes

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The fundamental basis for road crash analysis is a precise and sufficiently detailed examination of the crash scene, including the involved vehicles and their damage. Only a high-quality crash analysis can lead to the correct determination of the cause of the crash. The other way around, the inaccuracy of input data affects the accuracy of the resulting analysis of the crash event, and an incorrect analysis of the crash event can lead to an incorrect conclusion regarding the cause of a particular crash as well as incorrect determination of the culprit. Technological development also brings the development in forensic engineering and its procedures, methods and means. We addressed the topic of using modern methods for crash analysis in the research project *Modern Methods of Vehicle Damage Documentation and Analysis* carried out by the Czech Transport Research Centre CDV in cooperation with colleagues from the Institute of Forensic Engineering at the Brno University of Technology.

Every road crash is unique - not only regarding its course, but also the extent and character of vehicle damage, considering also the vehicle's final position and external conditions. Considering the location, high demands are placed on the time required for inspection. Losses from road crashes, which, according to our calculations, reached almost 115 billion CZK (around 4.6 billion EUR) in 2021¹ and over 131 billion CZK (around 5.3 billion EUR) in 2022² in Czechia, include not only personal consequences (costs related to injury or death of persons and material damage), but also other losses like the consequences of congestion. All these factors are necessary to take into account during the crash examination process and require continuous consideration of the advantages and limitations of available and potentially suitable methods including widely used methods (such as measuring rods, crush jigs etc.), but also modern methods such as 3D scanners or mobile devices. The aforementioned research project resulted in a practical guide for choosing a suitable method for the documentation and analysis process of vehicle damage³.

The crash analysis also requires assessing the adequacy and mutual correspondence of the vehicle's damage. To this end, the expert or liquidator of the insurance company must rely on the available evidence from the crash in question and feasible data sources. Especially in case of less common types of collisions and vehicle damage (such as crashes with different transport modes, low-speed or, on the contrary, high-speed crashes), the available data sources are often limited. At the same time, the experience with the analysis of these less common crashes is, due to its limited frequency, also lower, and therefore there is higher risk of misjudgement in the crash analysis process.

This all demonstrates the importance of collecting data on vehicle damage and the availability of valid data for crash analysis. Examples can be data from crash tests, but also databases/catalogues containing data from real traffic crashes or experiments. For this reason, we also created a database of vehicle damage characteristics, brought together in the *Catalogue of Characteristic Vehicle Damage*⁴. The catalogue is mainly based on the experience gained during the Czech in-depth accident

¹ <https://www.cdv.cz/tisk/celospolecenske-ztraty-z-dopravnich-nehod-v-roce-2021-presahly-hranici-100-miliard/>

² [Inflace se promítla do výše celospolečenských ztrát z dopravních nehod. V roce 2022 dosáhly ztráty rekordních 131 mld. Kč. | Centrum dopravního výzkumu, v. v. i. \(cdv.cz\)](https://www.centrum.cz/doprava/nehody/inflice-se-promitla-do-vyse-celospolecenskych-ztrat-z-dopravnich-nehod-v-roce-2022-dosahly-ztrat-131-mld-kc)

³ K. Bucsházy et al. (2023) Vehicle Crush Investigation: A Guidebook to Documentation and Analysis. <https://www.shopcdv.cz/en/VEHICLE-CRUSH-INVESTIGATION>

⁴ An example of damaged vehicles included in the catalog is available after registration: <https://katalog-poskozeni.cz/en/>

analyses, which have been conducted in the Czech Republic by the Transport Research Centre since 2011. However, the catalogue not only contains data from real crashes, but is appropriately supplemented with data from vehicle crash tests and experiments.

Working together with the Institute of Forensic Engineering, Brno University of Technology as a project partner and sharing knowledge with a specialist in the field (such as Experts in the field of crash analysis, Police), we hopefully maximise the likelihood of that knowledge being transferred into practice.

This column is written in a personal capacity and reflects only the views of the authors.