

František FOJTÍK\*, Pavel MACURA\*\*

INFLUENCE OF SAFETY ON HEADLIGHTS CONSTRUCTION

VLIV BEZPEČNOSTI NA KONSTRUKCI SVĚTLOMETŮ

**Abstract**

New trends and regulations force car producers to constantly innovate safety of their products in terms of preservation competing business, same demands are set to the suppliers. One of the most meaningful category, which nowadays sells the cars, is its safety. This safety doesn't feel free only on passenger safety in the car, but is also extended to the surrounding environment. This kind of safety is proved with aim of crash tests, executed directly on assembled cars, which is in itself expensive and the results are unreliable. Thereby want car producers from their suppliers to test their products before car assembly to obtain same results like in crash test.

**Abstrakt**

Nové trendy a předpisy nutí výrobce automobilů v rámci zachování konkurenceschopnosti neustále zdokonalovat bezpečnost svých výrobků. Stejně požadavky kladou automobilky i na své dodavatele. Jednou z významných kategorií, která v dnešní době prodává automobily, je jejich bezpečnost. Tato bezpečnost se neomezuje pouze na ochranu cestujících v samotném vozidle, ale je vztahována i k okolnímu prostředí. Tato bezpečnost se prověřuje tzv. crash testy. Tyto testy se provádějí přímo na hotových automobilech, což je samo o sobě velmi nákladné a výsledky jsou nejisté, proto automobilky tlačí na své dodavatele, aby testovaly své výrobky před montáží automobilu tak, aby byl výsledný efekt crash testu v obou případech stejný a vyhovující.

**1 INTRODUCTION**

Passive car safety is evaluated according to given prescriptions and on the basis of the results cars become so called stars. Since 2009 new procedure has been appointed. This new procedure states four thematic categories, concretely: protection of the adult passengers, protection of the children, protection of the pedestrians and assistance systems. New methodology tends to be more comprehensive in terms of car safety classification. Since 2009 organisation, evaluating car safety (Euro NCAP), started to test vehicles according to this methodology.

**2 PEDESTRIAN SAFETY**

On the basis of methodology, worked out by WG17 group – organisation EEVC, has arisen new category evaluating pedestrian safety. This category has gained more and more importance in recent years. More than one third of dispatched persons are pedestrians and unprotected traffic participants. This fact has been taken into account in legislation made by European Parliament. According to this, new guideline (2003/102/ES) has been published.

Guideline 2003/102/ES states demands on pedestrian and unprotected traffic participants safety in case of impact with safe-propeller motor vehicle. This guideline has been superseded by regulation ES 78/2009 [1, 2]. Mentioned guidelines and regulations are invoked by EURO NCAP institution, which realises car crash tests and creates its own detailed evaluations independent on homologation tests. In contrast to homologation tests, which give to the purchaser only information

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\* Ing., Ph.D., VŠB-Technical University of Ostrava, Department of Mechanics of Materials, 17. listopadu 15, CZ-708 33 Ostrava-Poruba, (+420) 59 732 3292, frantisek.fojtik@vsb.cz

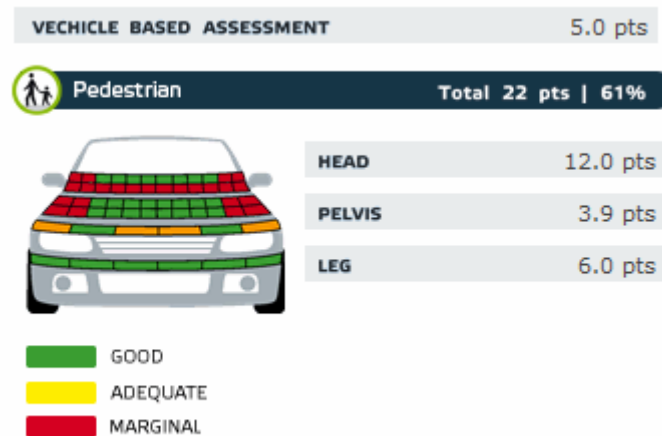
\*\* prof., Ing., DrSc., VŠB-Technical University of Ostrava, Department of Mechanics of Materials, 17. listopadu 15, CZ-708 33 Ostrava-Poruba, (+420) 59 732 3598, pavel.macura@vsb.cz

type: passed/not passed, the Euro NCAP system makes possible to give to the purchaser easy orientation on the pole of car safety from various car makers and classes [3].

In Table 1 is noted classification in category: pedestrian safety, valid in 2009 and necessitated in 2012. Practically, if vehicle gains five stars in 2009, this will be equivalent to three stars in 2012. In the Fig. 1 shows an example of test result of WV Golf according to Euro NCAP gained in 2009 [4].

**Tab. 1** Evaluation in category: safety of pedestrians.

Number of stars in category – Pedestrian safety	2009	2012
★★★★★	25 %	60 %
★★★★	15 %	50 %
★★★	10 %	25 %
★★	5 %	15 %
★	0 %	10 %

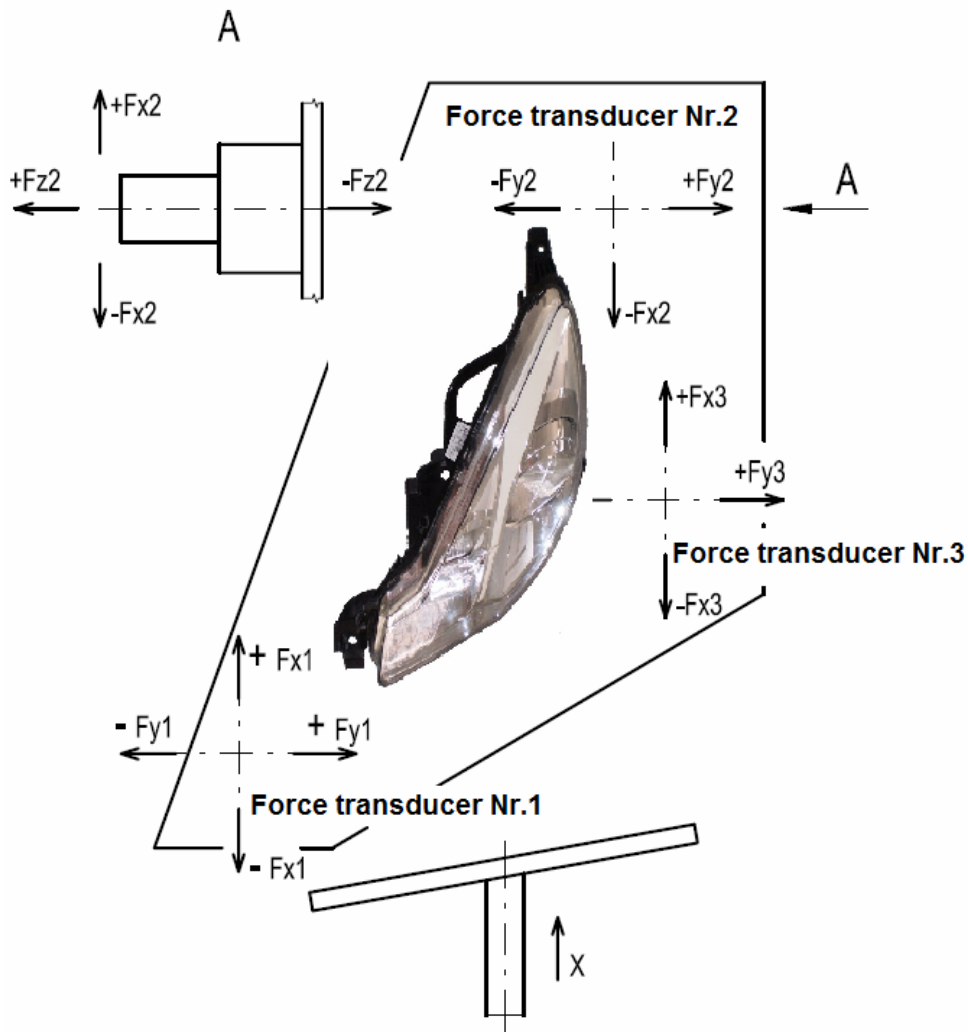


**Fig. 1** Test results of WV Golf

### 3 TESTING VEHICLE COMPONENTS

Car producers and their suppliers have on behalf of competitiveness to response flexibly on changes in legislative, published by European Parliament. On the basis of these instigations a test machine for headlights crash tests has been developed on VSB-TUO in cooperation with Visteon-Autopal. The test machine is capable to realize different types of tests, such as upper leg – impact of femurs, co called insurance impact.

The procedure has got following steps. Tested headlight is fixed on testing stand, which simulates chassis of the car. The stand is at points of headlight mountings recessed with force transducers, which measure force in three directions. These directions are noted in Fig. 2.



**Fig. 2** Orientation of force transducers on test stand

Force transducers have been planted on strain gauge device NI cDAQ-9172. Measured data are transferred into PC hard-drive [5]. The measured data are acquisitioned in real time and every measured signal is independently sampled with frequency of 10 kHz. After headlight fixation on the test stand is into the headlight fired appropriate impactor. Impactor velocity is scanned by optical respectively acceleration sensor.

Entire crash test is also recorded by high-speed camera, to evaluate deformation of the headlight. Fixation of the headlight is shown in the Fig. 3. The Fig. 4 shows a headlight after crash-test. The Fig. 5 shows characteristic behaviour of forces, measured by force transducers during one type of crash test. Amplitudes of the forces and their colour labelling are not mentioned for reasons of trade secret.

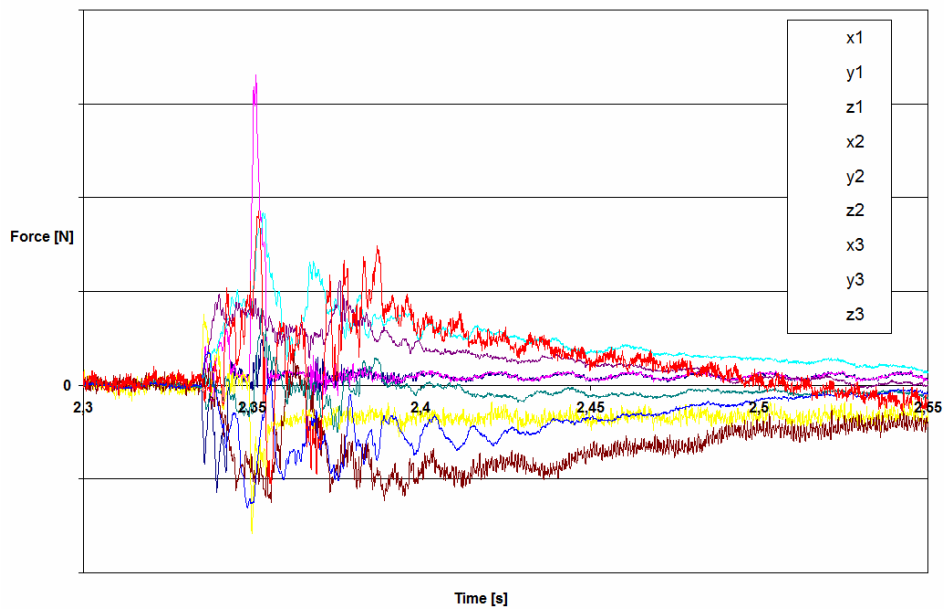


**Fig. 3** Placing of headlight in test stand



**Fig. 4** Deformed headlight after impact of the impactor

The results of measured forces in points of headlight mountings and gained headlight deformation in dependence on velocity and impact of the impactor are valuating groundwork for technical designing process. Thus gained experiences are used for attestation and optimisation executed constructional suggestions and FEM computations. One of headlights, which came through entire development is the headlight from new version of Citroën C3, shown in the Fig. 6, respectively Citroën DS3 [6]. Executed test led to constructional changes of the headlight shape and also to changes in used materials.



**Fig. 5** Gained behaviour of forces during crash test



**Fig. 6** Citroën C3 New.

#### 4 CONCLUSIONS

Products of car concerns are more and more overwhelmed by various tests, starting with crash tests and ends with responsibly tests after several years. The vehicles are also overwhelmed by various journalistic tests and advertising manias. All these tests are perceived by potential customer in an effort to purchase an optimal car for him. This view in turn forces the manufacturers to create a car not only attractive, cheap, reliable and last but not least safe not only for crew but also for its surroundings. Besides satisfied customer, there are also prescripts and legislation, which should car manufacturers respect. There is no choice to hope, so the effort for safer cars won't stay only on papers.

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