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Objective Rating of Modern Headlamps

Headlamps are the key element for orientation in night driving situations. A good illumination of the area in front of the vehicle is a major contribution to road safety. A new assessment standard is now being applied to headlamp quality. In 2011, the CIE presented a headlamp evaluation system that can objectively assess the quality of illumination and glare limitation. Since then, this document has provided an established assessment method for experts in research and testing and for the vehicle, headlamp and light source manufacturers. In total, 52 international organizations and companies contributed to this system developed by the CIE working group TC4-45, which was initiated by Euro NCAP and GTB (The International Automotive Lighting and Light Signaling Expert Group). The drawback of this evaluation system is the high complexity of individual data, which makes a simple and clear estimation difficult.

Current developments on the global market show the emergence of a variety of different already applied or announced test methods, which are internationally non-standardized, partly unpractical or only feasible with expensive equipment. Previous discussions have shown that such methods are highly susceptible to errors due to the randomness one has to deal with when conducting tests under outdoor conditions (vehicle, weather, measurement technology, environment, tolerances) and that they are not statistically meaningful due to an arbi-

trarily chosen vehicle (tolerances, equipment, condition) usually used for testing.

New light sources (LED) and lighting functions, such as glare-free (Adaptive Driving Beam, ADB) and partial high beam, have been available for several years, so that an extension of the TC4-45 method is necessary. This extension, among other things, should take into account the altered switch-on and usage times of low beam, high beam and ADB lighting functions and should be comprehensible to all users. The new, internationally available evaluation system should provide representative data and enable an objective assessment of headlamp performance.

The results must represent a clear description of the performance in terms of safety, regardless of the underlying technology. The main criterion for the evaluation will therefore be the effective range, which is considered to be relevant for safety in terms of object detection and reaction capabilities in critical situations. For the corresponding rating concept, erratic single measurements and unreliable outdoor tests with numerous high tolerance influences must be avoided. Research results on contrast and brightness perception shall be included. This new evaluation system is currently being developed as part of a cooperation between the TU Darmstadt and a broad group of experts under the title "Headlamp Safety Performance Rating."