LOOKING AHEAD: THE NEXT STEPS IN EURO NCAP´S SAFETY RATING

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Introduction

Over the last decades, the European New Car Assessment Programme (Euro NCAP) has become synonymous with crash testing and safety ratings. During this period, the total road death toll in EU-28 has been reduced by roughly a quarter, despite a significant growth in road traffic volumes [1]. One important factor is that cars in Europe have become much safer, due to vehicle safety regulations and industry's response to initiatives such as Euro NCAP.

The aim of Euro NCAP is to encourage consumers to buy safer cars and to provide incentives for car manufacturers to put safer cars on the market. At present the consortium is governed by 12 members, that include the Member State governments of the United Kingdom, Germany, France, Sweden, the Netherlands, Luxemburg and the regional government of Catalonia; the International Automobile Federation FIA; motoring clubs ADAC and ACI; Consumers International; and the Motor Insurance Repair Research Centre Thatcham. The vehicle safety tests supporting the rating are carried out at 8 independent test facilities across Europe. This cooperative network of members and laboratories makes Euro NCAP unique in its scope and market reach.

Since the start in 1997, Euro NCAP has published ratings on over 500 different vehicles, including supermini's, family cars and MPVs, roadsters, SUVs, pick-up trucks, vans, hybrids, full electric vehicles and, recently, quadricycles [2]. The reach of the program is such that most current models sold as new on the European market are covered by a Euro NCAP rating, even though consumer testing is not legally required (Figure 1). The large presence of rated vehicles in all popular segments provides a total view of the market and is a good barometer of the actual situation with respect to the safety of cars offered to consumers in Europe.

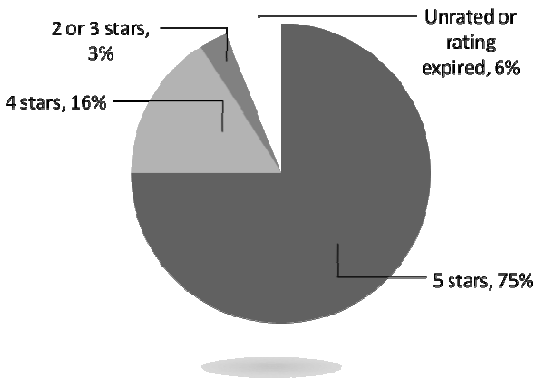

Figure 2. Most new car models on sale in Europe carry a Euro NCAP rating. EU28 passenger car & SUV 2016 first half year sales (Total sales 7.974.199 units).

Technology Advancement and its Effect on Vehicle Safety

In 2009 Euro NCAP moved away from publishing separate ratings for adult, child and pedestrian protection to a combined overall safety rating with a maximum of 5 stars for each vehicle [3]. As safety technology evolved and priorities shifted, the "encompass all" overall rating provided not only the ability to respond more adequately to market developments, but also, for the first time, to directly influence the safety research agenda of the vehicle industry.

To do so, Euro NCAP made several updates to the test suite that underpin the safety rating in the years following the conception of the overall safety rating [4]. First and foremost, a significant step forward was taken in the introduction of advanced driver assistance and crash avoidance system testing. Unlike passive safety, few pre-existing, standardised test procedures and tools have been available in this field. In close cooperation with vehicle industry, suppliers and test laboratories, relative simple yet effective methods were put in place to verify and improve the performance of active safety system on the market. These include Speed Assistance systems [5], Lane Support systems and Autonomous Emergency Braking systems for low and high speed rear-end crashes [6].

At the same time, further updates were made in the assessment of occupant protection, introducing more biofidelic test devices such as WorldSID and Flex-PLI,

better addressing rear seat occupant protection and refining the methodology of evaluating pedestrian [7] and child occupant protection.

The combined effect of the introduction of new and updated tests with more demanding scoring thresholds has redefined the meaning of 5 stars and has significantly boosted the base equipment levels of European passenger cars and vans. Whereas until 2009, most cars comfortably would achieve a 5 star rating, the number of 4 and 3 stars ratings started to increase again, especially for the smaller segment cars (Figure 2).

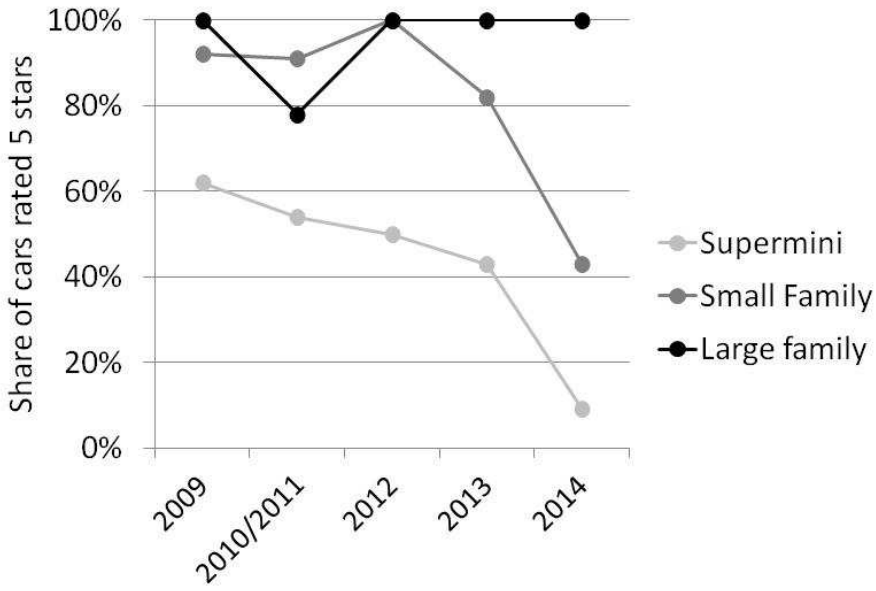

Figure 2. From 2009 onwards, Euro NCAP has made incremental updates to the rating, adding amongst others crash avoidance technology. In particular for cars in more price sensitive segments, 5 stars have become more difficult to achieve.

Recent Rating Developments

Building upon the innovation potential in sensing technology and algorithms, cars are becoming increasingly more automated and better able to mitigate or avoid crashes. Euro NCAP has recognised the opportunity that advanced technologies offer to further reduce road casualties, not only for car occupants but also for vulnerable road users. To deliver this, the organisation has announced that it will further develop the safety rating, incorporating the latest generation of available safety technologies,

driving more robust performance in real-world situations and promoting good overall crash protection for all types of passenger vehicles and for all sizes of occupants.

Occupant protection in front and side impact crashes

Euro NCAP sees the roll out of vehicle automation as a way to significantly improve vehicle safety and safe driving. However, with over 25,000 people killed in European traffic every year and many active safety systems still limited in their performance, there is little room for complacency on crash protection.

In the most recent revision of the Euro NCAP rating scheme in 2016, 6 and 10 year old child dummy sizes were introduced on the rear seat. This update of the child occupant protection assessment has been the last phase of a multi-year protocol overhaul process that started with the introduction of the CRS installation check in 2013. The 2016 COP assessment emphasises the need for cars to accommodate universal and i-size child seats in the most common installation modes and is promoting better rear seat restraint system design for children and adolescents.

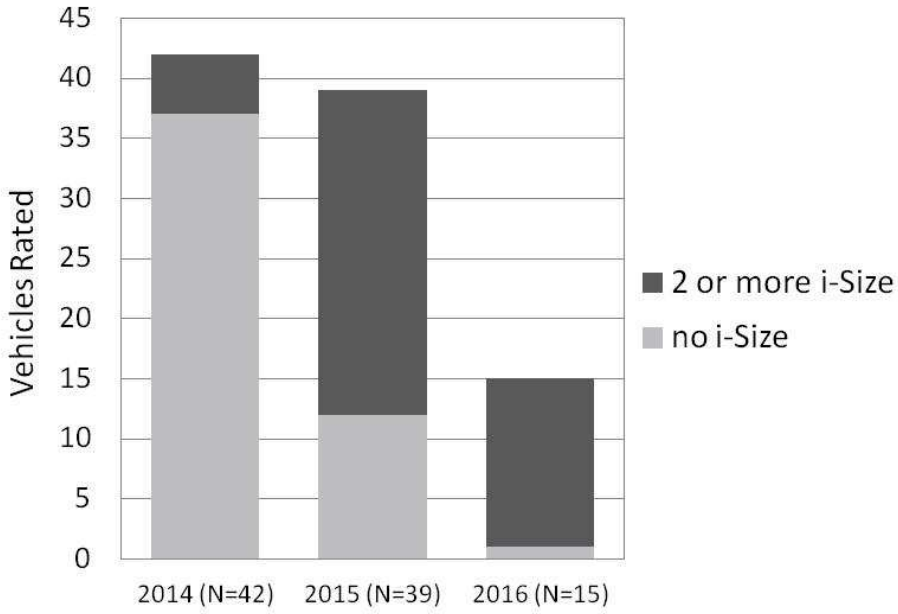

Figure 3. Following the 2013 COP update, many vehicle manufactures have started to offer two or more i-Size compliant seating positions, which greatly improve protection and reduce the risk of CRS misuse. Results released up to August 2016.

Incremental improvements in vehicle structural design can deliver a more crash-compatible vehicle fleet. Work has started on the development of a new moving progressive deformable barrier test that is scheduled to replace the existing 64kph ODB static barrier test in the program by 2020. An in-depth study of frontal offset crashes in Europe has led into a review of the future barrier configuration, barrier face build specification and on the test trolley design. The feasibility of using the THOR-M dummy, its calibration procedures and injury criteria is studied in cooperation with the Enhanced Vehicle Safety Committee (EEVC-TEFIRE group). The introduction of a metric for vehicle compatibility applied to the results of this test is also being considered.

Improved restraint solutions could address more complex occupant loading in oblique or far-side crashes and effectively help reduce injuries. Far-side crashes represent a fair share of all side impact fatalities and seriously injured, and evidence is lacking about the effectiveness of near side impact restraint solutions in far-side crashes. Euro NCAP's approach is one based on simulated environment on a sled, which would allow the vehicle manufacturer to demonstrate the effectiveness of far-side protection solutions to Euro NCAP. Feasibility testing and simulation is underway to prove the concept and value of this approach. If successful, the assessment will be phased in as of 2018 (Figure 4).

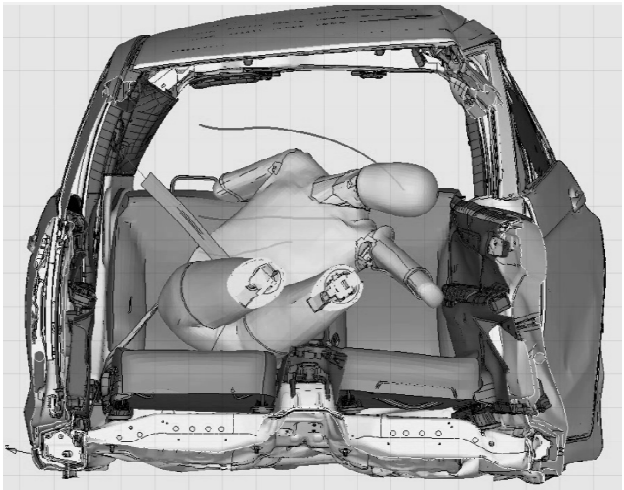

Figure 4. Ongoing investigations into far-side protection include sled testing and CAE simulations (ACEA, 2016).

Safety assist technology

Following the adoption of ESC in 2011, Speed Assistance systems in 2013, and Lane Support and AEB systems in 2014, the focus has been on extending the scope and performance of these technologies.

Autonomous Emergency Braking systems have already been proven to be effective in reducing rear-end collisions and are fitted as standard equipment to more and more vehicles since the introduction in 2014 [8]. For AEB car-to-car technologies, initial test scenarios were limited due to the available surrogate vehicles used for testing. With the joint development of a new 3D full vehicle (GST) target, these limitations will no longer exist and more challenging and realistic scenarios will be included in 2018 and 2020 when head-on and turning scenarios are added to the portfolio.

Figure 5. AEB testing will continue to expand in 2018 with the introduction of the Guided Soft Target (GST).

With the swift developments in detection algorithms and scope of AEB systems, the function requirements of these systems have recently been extended by including Pedestrian Detection technology (as part of the Pedestrian Protection assessment). In 2018, this will be followed by the inclusion of Cyclist Detection. Similar to AEB car-to-car technologies, turning scenarios will be added for AEB Pedestrian in 2020 which, amongst others, will push for wider-view sensors.

In lateral control, Euro NCAP is also encouraging more and more advanced systems, which performance exceed the typical ISO requirements for lane departure warning. It is well understood that frequently intervening systems, like Lane Support Systems, have a low use rate when these systems are issuing an audible warning. For that reason, the requirements are developing in the direction of automatically intervening systems instead of systems that reply on warning. From a technology perspective,

systems are not only expected to be able to detect road edges (over and above lane markings), but also avoid the vehicle to drift into oncoming traffic and refrain the driver to intentionally change lanes when being overtaken by other road users.

As a last pillar in safe driving, Euro NCAP has also been successful in the inclusion of Speed Assist Systems (SAS) with the aim of supporting the driver to maintain safe driving speeds (Figure 6). Since longer time, manually set speed limitation systems are installed on cars. In 2014, the assessment of the Speed Limitation Function was added to the scheme where drivers are informed of the legal speed limits based on map data or camera recognition. The SAS protocol has been evolving over time, tasking account of the complexity of being able to identify all conditional and implicit speed limits in Europe. The latest revision, for implementation in 2018, will promote camera and map technology to the limits including a deeper integration into the vehicle infrastructure. Conditional speed limits based on time or weather need to be correctly indicated to the driver, where ultimately the known speed limits are automatically adopted by a speed control function like a speed limiter or intelligent ACC.

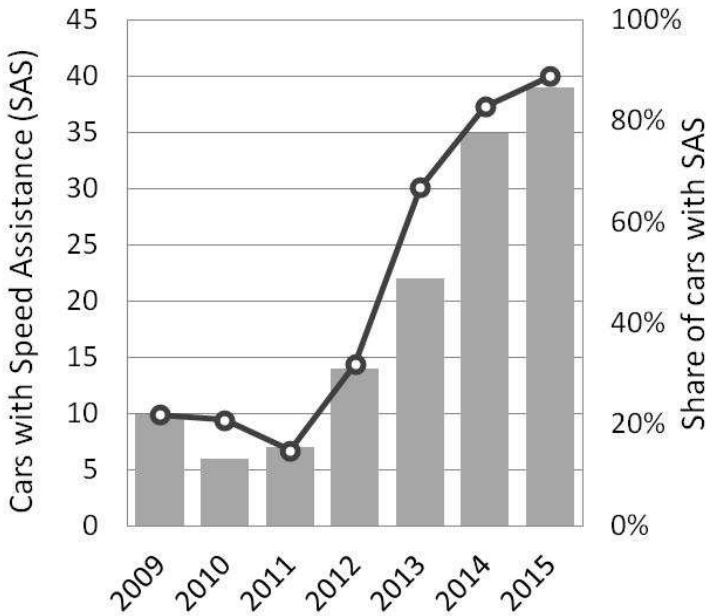

Figure 6. Speed Assistance systems entered the mainstream as the number of cars equipped with the technology has significantly increased in recent years.

Outlook 2025

For several years, Euro NCAP has recognised that active safety technologies can bring safety benefits, either by aiding safe driving or by intervening to help avoid an accident crash if one is imminent. Technology is evolving quickly and more and more of the driving function is being handed to the vehicle. The potential safety benefits of this increased automation are clear, given that around 90 percent of road accidents are attributable to driver error. It is therefore in Euro NCAP's interests to raise awareness of automated driving technologies that exist and to promote their introduction in such a way that the safety benefits are realised. At the same time, we need to check that these technologies do not introduce new risks with a potential negative impact on safety.

Public expectations of automated driving are high, although understanding may be low, and car manufacturers will naturally seek to promote the technologies they offer. In such an environment, it would be easy for consumers to base their purchasing decisions on information provided by the manufacturer. In this situation, Euro NCAP can clarify availability and inform consumers on what is and what is not automated driving, go beyond legislation to provide information about the relative performance of systems in critical situations, and ensure that safety remains a factor in consumers' purchasing decisions when it comes to automated driving technologies. Given the step-wise development of technologies, it makes sense to assess automated driving on a function by function basis i.e. the scenarios in which automated driving is provided to be assessed separately. This would allow consumers to compare the results of one vehicle with those of another in the same driving situation.

Besides rating of automated driving technologies, Euro NCAP plans to develop the overall safety rating incorporating both updates in test methodology and new intervention systems such as evasive steering. Last but not least, it will continue to expand its scope from safety of passenger car and vans, to quadricycles, PTWs and lorries.

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