SWOV Fact sheet

Euro NCAP, a safety tool

Summary
Since 1996, the Euro NCAP programme has been testing the (crash) safety of the most widely sold cars. The fact that consumers are familiar with the test results encourages the car manufacturers to produce cars that are often safer than is required by law. Euro NCAP tests the (secondary) crash safety for adult occupants, for child occupants and for pedestrians as crash opponents. Since 2009, points can also be earned for the presence of devices for the prevention of crashes (primary safety), such as electronic stability control and speed limiters. During the last few decades cars have become noticeably (crash) safer. However, the exact safety effects of Euro NCAP are difficult to determine, among other things because mass differences between cars have not been included in the assessment. For this reason, the test result only gives insight into the crash safety within the same class of model and weight. The increased attention paid by Euro NCAP to primary safety is expected to result in stepped up implementation of primary safety devices. This is a positive development, as it is more effective to prevent crashes than to reduce the severity of the injury in case of a crash.

Background and contents
Euro NCAP stands for *European New Car Assessment Programme*. Euro NCAP aims to enhance vehicle safety by testing various car models and publishing the results. The aim is to encourage consumers to buy safer cars and to put pressure on designers and car manufacturers to put safer cars on the market. This way, they want to exceed the legal (European) standards for the safety of vehicles by using the free market system. This fact sheet will discuss the background of the Euro NCAP organization and the method, tests and methods of assessment, in that order. Next, a number of short comments will be made on Euro NCAP and the effect on safety will be presented.

What is Euro NCAP?
Euro NCAP (www.EuroNCAP.com) provides both car buyers and car manufacturers with realistic and independent assessments of the (crash) safety performance of the most popular and common cars sold in Europe. The Euro NCAP programme for new cars was introduced in 1996, following similar test programmes in the United States (USNCAP). Next came Australia (ANCAP), Japan (JNCAP) and Latin America (LatinNCAP). Although there is an extensive set of legal European regulations and directives concerning requirements that cars must meet before they are allowed on the road, Euro NCAP sets safety requirements to new cars that are generally more stringent.

The Euro NCAP board consists of representatives of seven national governments (Catalonia, England, Sweden, Luxemburg, France, Germany and the Netherlands), the Fédération Internationale de l'Car mobile (FIA) with the German ADAC as its test home, Thatcham, on behalf of a number of British car insurers and International Consumer Research & Testing (ICRT). Being the Dutch participant, the Ministry of Infrastructure and the Environment is involved in Euro NCAP. The Royal Dutch Touring Club ANWB participates as a member of FIA and the Dutch consumers organization Consumentenbond is involved as a member of ICRT.

How does Euro NCAP operate?
Euro NCAP officially determines which car is tested in which laboratory. Governments as well as car manufacturers can suggest cars for testing. In the latter case, Euro NCAP will test three of the twenty vehicles (of the same model) that the manufacturer suggests as options. Euro NCAP groups the cars in various model classes, such as passenger car (‘small and large’), multiple purpose vehicle (MPV; ‘small and large’), SUV (‘small and large’), sports car and pick-up truck. Within these categories cars are only allowed to be compared with each other when they differ less than 150 kg in weight.

By law, all new car models have to meet specific safety requirements (ECE regulations and EC directives) before they are allowed on the road. However, the European c.q. Dutch legislation only sets a number of *minimum* requirements that the secondary (crash) safety of new cars has to meet

(also known as passive safety or injury prevention). It is Euro NCAP's aim to encourage car manufacturers to exceed these minimum (crash) requirements in the interest of both the car occupants and the other traffic users, among whom pedestrians.

What is tested in Euro NCAP and how is this assessed?
Early 2009, the Euro NCAP tests and assessment system were drastically revised. *Table 1* gives an overview of the various Euro NCAP subtests, divided into four groups since 2009. Group 1 looks at secondary safety of adult occupants, group 2 at that of child occupants and group 3 at that of pedestrians as crash opponents of a car, and group 4 investigates the presence of a number of 'intelligent' safety devices. Besides seat belt reminders, these also include a number of primary safety devices, that is to say, for the prevention of crashes (earlier known as active safety). Prior to 2009, these types of safety devices were not part of the Euro NCAP assessment.

Group 1 (36 points) **Adult occupants**	**Group 2** (49 points) **Child occupants**	**Group 3** (36 points) **Pedestrians**	**Group 4** (7 points) **Safety devices**
• Frontal impact • Side impact • Against pole • Whiplash	• Frontal and side impact • Use of child restraint • Appropriateness car	• Adult head and child head on bonnet • Adult lower leg against bumper • Adult upper leg against bumper and bonnet	• Seat belt reminder • Electronic stability control • Speed limiter

Table 1. *Test parts of Euro NCAP.*

Until 2009, the final assessment was expressed in the number of stars earned by testing the safety of adult occupants. The crash safety of children and pedestrians was also tested, but the results were not included in the final assessment. Five stars was the maximum. Now points are used and, subsequently, percentages. A different number of maximum points can be earned for each group. Within a group, more points can be earned for more important tests than for less important tests. The final assessment follows from the scores earned in the four groups. For each group, the score is converted into the percentage of the maximum number of points earned. Next, weighing factors are added, because the adult safety group, for instance, is considered more important than the child safety group. The final percentage determines the number of stars the car is awarded. A final percentage of at least 80% is required for five stars.

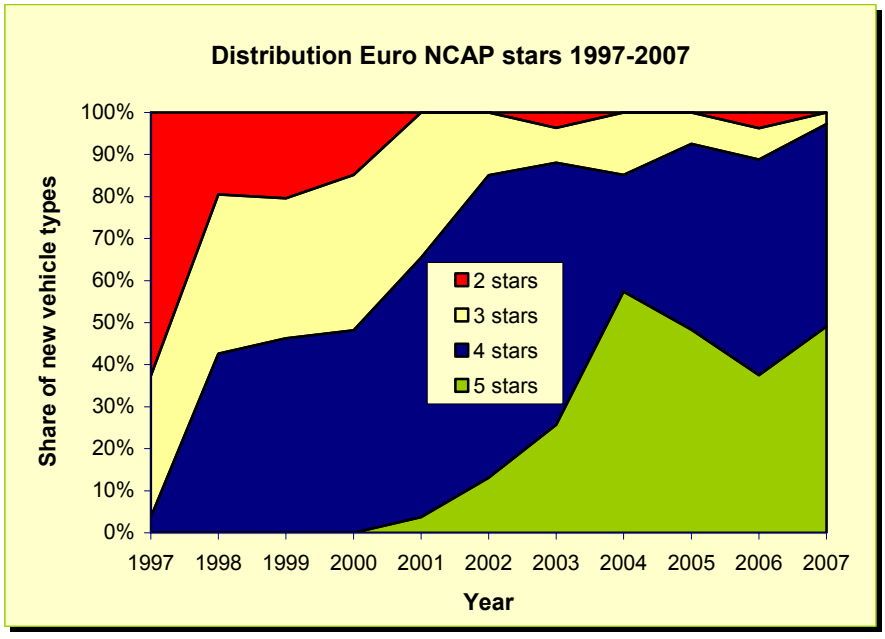
Car manufacturers are only allowed to use the Euro NCAP results for promoting the tested car or for a 'proven variant' of the tested car, sold in Europe. A 'variant' is the same car model, yet in a slightly different version, for example, a station wagon or a car with the steering wheel at the other side. The car manufacturer must be able to show that the 'variant' has the same constructive features as the tested car.

What are the effects of Euro NCAP?
In order to be able to determine the link between the Euro NCAP assessment and the injury rate for occupants, Lie & Tingvall (2000) used the data of real crashes to determine the link between the number of stars and the injury rate in practice. Of course this concerns the 'old' Euro NCAP method without points for the safety devices of group 4. Lie & Tingvall notice in their study that vehicle mass has a substantial effect on the outcome of crashes. Since Euro NCAP more or less allows for the (different) mass by classifying cars in different categories, the stars for various classes cannot be compared. For this reason, Lie & Tingvall corrected for the effect of mass. By so-called paired analysis of data of Swedish car-car crashes, these researchers found a correlation between cars with more or fewer stars and the injury rate. This correlation was only determined for crashes with severe injury or fatale outcome. With respect to the impact of the effect, the authors conclude that in general about 30% fewer fatalities and seriously injured occurred in cars with three and four stars than in cars with two stars of less.
This strong effect from the Lie & Tingvall (2000) study was no longer found in the later European PENDANT study (Pan-European Accident and Injury Databases). This study was an analysis of passenger car crashes from the years 2003-2006 by the Netherlands Organization for Applied Scientific Research TNO (De Vries, 2006). TNO concluded that cars with four or five stars do not perform significantly better than cars with two or three stars. However, De Vries states that an

advanced analysis method could have resulted in a different outcome. For instance, mass differences had not been taken into account for the various Euro NCAP categories.

According to Zobel, Strutz & Scheef (2007), assessing only secondary safety is not enough when it comes to the total effect of vehicle measures for road safety. Also safety devices such as seat belt reminders (see SWOV fact sheet *Seat belt reminders*), Electronic Stability Control (see SWOV fact sheet *Electronic stability control (ESC)*) and speed limiters are important for ultimate safety, because they reduce injury or even help to prevent crashes. Broughton (2009) and Page et al. (2009) also conclude that more can be gained in the coming years from primary vehicle safety than from secondary safety. As stated, the Euro NCAP assessment has now taken this into account.

When looking at developments over time, crash safety of cars has increasingly improved (De Vries, 2006; Broughton, 2009). Therefore, the same car model has become a great deal crash safer since the introduction of Euro NCAP. In 1998, VW Golf was awarded three stars and in 2008 it was awarded five stars. This is because the car manufacturers have been producing increasingly safer cars, partly based on crash studies, laboratory tests and new test methods. This is actually another reason why the effect of Euro NCAP is so difficult to quantify. In the early stages of Euro NCAP the differences in crash safety between cars were rather substantial, but nowadays these differences are less evident. SWOV has also established in various publications that cars have become significantly (crash) safer over the last few decades (e.g. SWOV, 2007; Van Kampen, 2007). Through the years, the share of cars with four or five stars has increased considerably. In 1997 circa 5% of the tested cars earned four stars and none of the tested cars earned five stars. Ten years later, in 2007, circa 95% of the cars earned four or five stars (see *Graph 1*).



Graph 1. *Share of Euro NCAP stars for new types of vehicle on the European market for the safety of adult occupants in the old Euro NCAP system (Source: www.euroncap.com).*

What are the limitations of Euro NCAP?

The European car models have become much safer during the last few decades. Especially the stronger cage construction of European car models protects occupants increasingly better during a frontal collision. Nevertheless, there are limitations. At present, Euro NCAP does not allow for mutual mass differences in frontal car-car collisions (incompatibility), whereas this in particular is a very determining factor in the further outcome of a crash. Another phenomenon is that heavier cars have also become more unyielding (less shock absorbing) and therefore are at an advantage in a crash with a lighter car in terms of protection of the occupants (Mori et al., 2007). It is therefore important to set high requirements to the crash friendliness (energy absorption) of the fronts of cars (Ablaßmeier et al., 2007) and the strength and the design of cage constructions (O'Neill, 2009).
Due to both mass and rigidity, safety for the occupants increases with vehicle mass, whereas safety for the occupants of the crash opponent car decreases with vehicle mass (also see Berends, 2009).

As long as Euro NCAP does not test this incompatibility, the number of stars gives good insight into the safety within the same model and size class, but not between the various classes.

The above incompatibility problem is all the more important because of the trend to make cars smaller and more lightweight for reasons of environmental targets. As a result, Euro NCAP and various other road safety organisations are now discussing how to deal with these differences in mass between cars.

It is more effective for road safety to prevent crashes than to reduce the severity of injuries of car occupants in crashes (Ablaßmeier et al., 2007). The attention paid by Euro NCAP to primary safety devices, such as an ESC-system, is therefore positive. It is, however, important to keep secondary safety at at least the same level. The new Euro NCAP assessment now awards extra points when this kind of safety device is installed. However, until now no test methods have been available to determine the actual safe functioning, which is a limitation.

Conclusions

Euro NCAP has been active since 1996 and provides both consumers and car manufacturers with independent assessments of the (crash) safety performance of the most common car models in Europe. The fact that consumers are familiar with this information encourages car manufacturers to produce cars that are often safer than is required by law. Euro NCAP tests the (secondary) crash safety for adult occupants, for child occupants and for pedestrians as crash opponents. Since 2009 points can be earned for safety devices that have been installed to prevent crashes (primary safety). Dutch and international statistics show that cars have become increasingly (crash) safer during the last few decades. In the last ten to fifteen years this has at least partly been thanks to Euro NCAP. Nevertheless, the safety effects of Euro NCAP have been difficult to determine until now. This is mainly because all cars have become safer and, due to increased differences in mass, more lightweight cars are at a disadvantage. So far this incompatibility has not been allowed for in the Euro NCAP assessment. Hence, the number of stars gives good insight into the safety within the same model and size class, but not between the various classes. Euro NCAP and other organizations are therefore presently discussing how to solve this incompatibility problem in the future. As, since 2009, Euro NCAP has implemented a new test and assessment programme which includes primary safety devices, it can be expected that this will result in a faster implementation of devices such as ESC and speed limiters. As long as a solution of the incompatibility problem is not to be expected, the increased attention paid by Euro NCAP to primary safety, and, subsequently, the prevention of crashes is an excellent step.

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