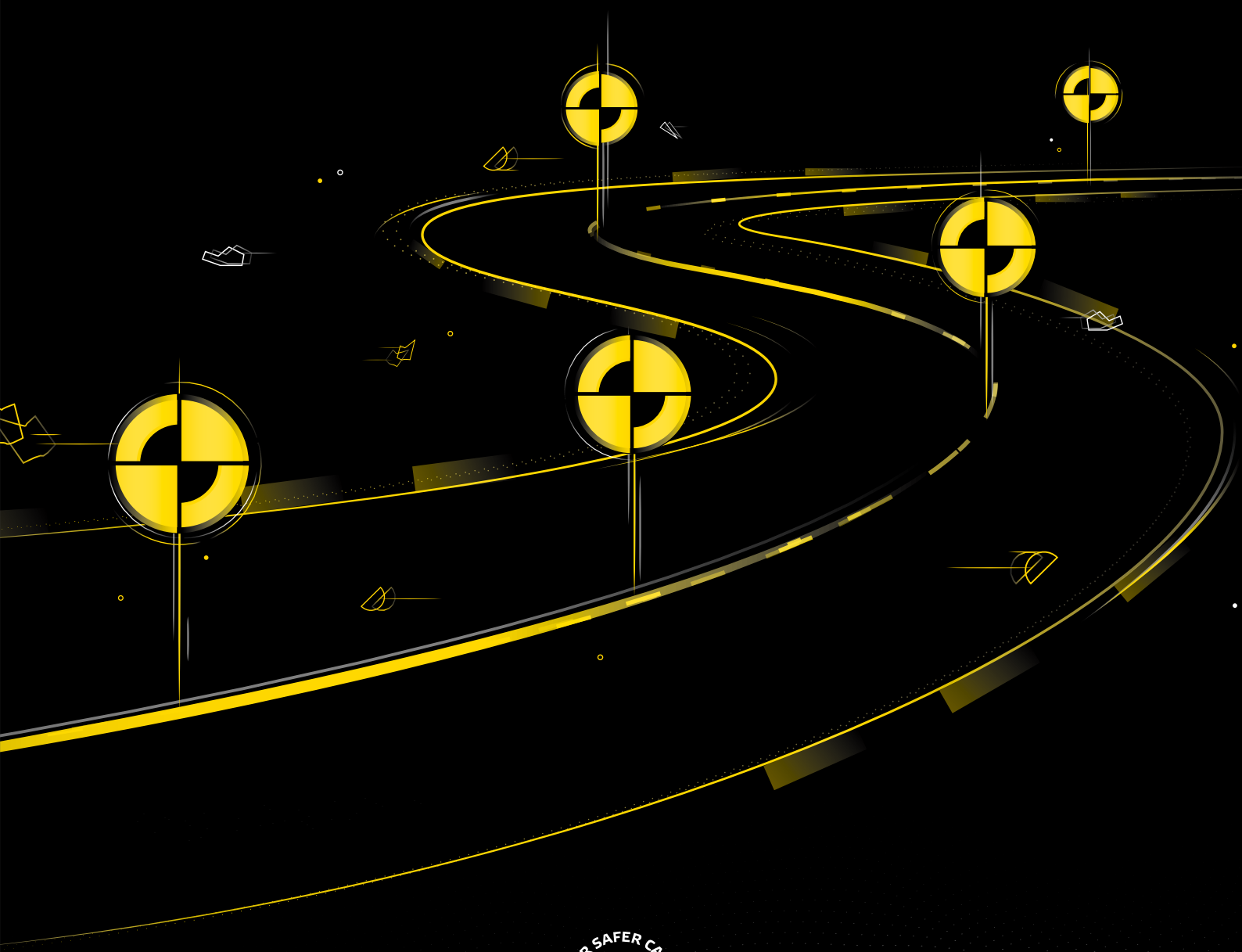
Euro NCAP 2025 Roadmap

IN PURSUIT OF VISION ZERO



FOR SAFER CARS
EURO NCAP

Executive Summary

The focus of the roadmap is on the use of advanced technology to deliver improved passenger car safety but also on how it might assist other road users. The continued use of the overall rating scheme is envisaged, with its separation of assessment into one of four areas, but a move is proposed to a more scenario-based scheme in the future and to greater use of simulation to provide a broader and more robust assessment. An assessment of automated driving is proposed, outside of the main star rating scheme. For primary safety, driver monitoring (start date 2020) is proposed, to mitigate the very significant problems of driver distraction and impairment through alcohol, fatigue, etc. A reward is foreseen which is related both to the problems detected by the system and to the action taken — warning in the first instance, but also speed limitation etc. Autonomous Emergency Steering (AES, 2020) is a technology in its infancy and changes to legislation, expected in 2022, are needed to allow full exploitation of its potential but driver-initiated, in-lane steering support could be rewarded early in the roadmap period. Further developments in Autonomous Emergency Braking (AEB, 2020), to address cross-junction, head-on and reversing accidents are proposed. Finally, V2X communication (2024) offers great potential but agreement is first needed on the technology employed.

In the field of secondary safety, a review of whiplash testing will rationalise and simplify the testing effort. For pedestrian protection, an upper-body-mass leg impactor will yield more realistic test results while headform testing will be extended to include cyclists.

For the first time, tertiary safety is addressed. From 2022, a reward is given to Child Presence Detection, which can detect a child left alone in a car and alert the owner and/or the emergency services, to avoid heatstroke fatalities. A relatively low-technology approach is proposed for assisting rescue teams to extricate occupants from a crashed vehicle. Euro NCAP will collaborate with CTIF to ensure the availability of standardised rescue sheets.

Executive Summary

Automated driving can offer great safety potential by helping to eliminate driver errors. Euro NCAP will promote the rapid, safe deployment of this technology into the vehicle fleet by means of a categorisation of the type and degree of assistance/automation offered, outside of the main star rating scheme. At the same time, Euro NCAP will provide information to consumers to allay fears but also to maintain realistic expectations of the degree of automation offered and of the need for vigilance in cars where the level of automation is low or is not universal.

Finally, in the areas of truck city safety, powered two-wheelers and cyber-security, the roadmap outlines projects with which Euro NCAP may be associated whilst not necessarily taking the lead role.

Preface

Before you lies Euro NCAP's roadmap for the period between 2020 and 2025. The document provides guidance on the future developments and activities of the European consumer safety program and may serve as a reference for the automotive industry and other stakeholders.

Forward planning for this transient period, where available technology and the boundary conditions are evolving rapidly, was difficult. Over the last months, Euro NCAP has reached out to key external stakeholders in the industry to discuss our first thoughts about the future safety rating and its role in promoting automation. Debating these issues face to face has helped us to identify the opportunities for vehicle safety improvement and better understand the challenges that the automotive industry is facing.

Euro NCAP wishes to express its sincere gratitude to all who participated in the consultation meetings and who have provided the very valuable feedback and suggestions.

Leuven, 12 September 2017

1/ Introduction

It has been said that the auto industry will change more in the next five to 10 years than it has in the last 50 and this may very well be true for vehicle safety technology. Automated driving technologies, now rapidly developing, will transform the driving experience and the auto industry as a whole. At the same time, Europe's inevitable shift towards an era of electric vehicle propulsion is expected to accelerate, with 30 percent of sales electric by 2025 (UBS, 2017).

As an advocate for safer cars, Euro NCAP aims to highlight automated driving technologies and raise awareness of their benefits. But Euro NCAP will also keep challenging vehicle manufacturers on what they are actually selling to consumers on the European market. This means offering the best possible technology as standard in all segments and countries, protecting car occupants of all ages, sizes and shapes and to also look out for the safety of other road users in traffic.

With 256 million cars in use, Europe has the world largest passenger car fleet. In 2016, over 14 million new cars were registered (ACEA, 2017). Traditionally, the smaller A- and B-segments dominate the passenger car sales in numbers, while the mid-sized Sport Utility Vehicle segment is one of the fastest growing. Over 95 percent of new model sales in these segments are covered by a rating, so it is probably fair to say that Euro NCAP has a strong influence on the fitment and performance of vehicle safety systems in the market.

Despite having one the highest motorisation rates, roads in Europe remain the safest in the world: in 2016, the EU-28 counted 50 road fatalities per one million inhabitants, against 174 deaths per million globally (European Commission, 2017). Car occupants account for almost half of road accident victims. However, all combined, pedestrians, cyclists and motorcyclists make up almost the same share. Looking beyond the fatality number, it is estimated that 135,000 people are seriously injured on European roads each year (European Commission, 2017). Indeed, most of those seriously injured are vulnerable road users and many are elderly, an age group that is growing in importance.

The more widespread availability and affordability of the technology that enables Advanced Driver Assist Systems, such as AEB and LDW, has resulted in a significant increase in the uptake of such technology in recent years. Still, the number of cars in the fleet equipped with state-of-the-art ADAS remains relatively low and will not yet have significantly changed common crash types or the frequency of vehicle crashes. This is particularly true for ADAS systems designed to address vulnerable road user crashes, which are only just emerging on the market. On the other hand, the widespread availability of better-established or mandatory technologies, such as side curtain airbags, SBR and ESC, have had a clear impact on the frequency of some fatal or injurious crashes such as single vehicle roll-overs. In developing a longer-term agenda for vehicle safety, it is important to account for the changes in real-world priorities and the anticipated impact of emerging safety technologies.

Equally important is to understand how the consumer mindset is changing and what it means for the car market. Last year, the average car age in Europe rose again, to over 10 years, some two years more than it was a decade ago (ACEA, 2017). This adds pressure on organisations like Euro NCAP that advocate widespread and timely adoption of important safety technology across the region. The average car buyer is getting older as well, as lifespans extend and young people become less able or willing to own a new car. Carmakers are expanding mobility services such as car sharing, in order connect young consumers to their brand.

To stay influential and relevant in this widening landscape, vehicle safety information will not only have to appeal (and be helpful) to the traditional car buying public, but also to other user groups or business models. The overall safety rating, a simple yet powerful tool in communicating about vehicle safety, will remain one of Euro NCAP's most important output channels; however, to reach consumers in their "content cocoons" and to connect with a broad range of potential other users, Euro NCAP will also need to develop attractive stories around safety-related topics.

In the upcoming years, significant changes to the regulatory landscape and to the content of vehicle safety type approval are anticipated. The European Commission has announced a revision of General Safety Regulation 661/2009, potentially including several new measures that are part of consumer testing today (European Commission, 2016). Euro NCAP must ensure that its safety ratings will complement those developments and reward higher performance in a faster timescale than regulation requires.

2/ The Overall Safety Rating

Euro NCAP has already introduced some important updates to the crash test program in recent years and revisions to the front and side impact tests are planned for 2020 (Euro NCAP, 2015). This shows that secondary safety is and will remain at the heart of Euro NCAP's consumer ratings for some time. But Euro NCAP has clearly recognised that primary safety has an increasingly important role to play. As the rate of development in this area accelerates, the safety rating is expected to include more and more ADAS and crash avoidance technologies, introduced by vehicle manufacturers. In the upcoming period, Euro NCAP will also pay more attention to tertiary safety in the rating using the Haddon matrix (Haddon, 1972) as guidance. Hence, the strategy going forwards will emphasise primary, secondary and tertiary vehicle safety as important enablers on the road to vision zero.

It is the intention that the Overall Rating System and methodology (van Ratingen, 2008) will remain in place, at least for the time being. It is clear, however, that there is an increasing amount of overlap between safety technologies offered on the market and that there is more than one way in which a particular crash scenario could be dealt with in terms of injury mitigation and/or avoidance. Euro NCAP recognises the need to address more effectively the way in which primary, secondary (and tertiary) safety elements are integrated.

During the coming years, a transition is foreseen from a "technology based" approach (e.g. tests for AEB) to a more "scenario based" assessment that would allow various types of interventions (e.g. braking and steering). At the same time, passive safety test methodology will be updated to allow for pre-crash activation of restraints. This review of the overall rating methodology will also address opportunities to exploit virtual testing to add more robustness to the assessment. This transition process will phase in from 2022 and is expected to be completed by the end of the roadmap term in 2025. Ensuring stability of the rating during this transition will be essential.

Based on the evolution of safety technology in the fleet, Euro NCAP plans to introduce several new test items under the overall safety rating. These items may be added or partly replace existing tests. The timescale refers to the expected first introduction date in the rating scheme. More details can be found in the Roadmap 2025 graphical timeline (see p.17).

As a final introductory remark, it should be noted that Euro NCAP will continue to closely monitor the frequency and nature of real-world crashes and advancements in technology during the roadmap implementation years. Where appropriate, it will pursue available possibilities to test and rate important new features beyond those that already have been identified here. This would allow us to rapidly give credit for important safety innovations.

PRIMARY SAFETY

Driver Monitoring (2020)

More than ninety percent of road accidents are caused by "human mistakes". In general, two kinds of mistakes can be observed: violations, of which speeding and driving under the influence of alcohol or drugs are most common; and human "errors", in which the driver state - inattentiveness, fatigue, distraction - and inexperience play an important role. In an aging society, sudden medical incapacitation is also a growing cause of road crashes.

Already, driver advisory systems such as Speed Assistance Systems (SAS) and Attention Assist target the human element in crashes by alerting the driver in critical situations and, ultimately, by supporting the driver to improve his behaviour. In addition, adapting intervention criteria to individual drivers and the driver's state may provide a significant potential for earlier interventions in the future without compromising false-positive levels.

Euro NCAP envisages an incentive for driver monitoring systems[1] that effectively detect impaired and distracted driving and give appropriate warning and take effective action e.g. initiating a safe evasive manoeuvre, limp home mode, increased increasing sensitivity of Electronic Stability Control, lane support, speed, etc. Implementation in the overall rating is planned in phases, starting with systems that have already entered the market. The assessment will evolve around how reliably and accurately the status of the driver is detected and what action the vehicle takes based on the information. Other aspects, such as driver position monitoring, could be added in future iterations of the protocol.

[1] *Effective driver monitoring will also be a prerequisite for automated driving, to make sure that, where needed, control can be handed back to a driver who is fit and able to drive the vehicle. This item will be taken on board under the HMI requirements for Automated Driving.*

Automatic Emergency Steering (2020, 2022)

Current AEB systems show potential to avoid or mitigate many crashes but Automatic Emergency Steering, or AES, although technically more demanding, may deliver a further significant reduction in crashes and casualties, in particular for single vehicle and small overlap crashes and accidents involving vulnerable road users.

- About 20 percent of Killed and Seriously Injured (KSI) originate from loss of control or lane or road departure (STATS 19, 2015)[2].
- Frontal collisions with a small overlap account for around 15 percent of all car accidents and 25 percent of all car accidents involving a frontal collision (German Insurance Association, 2013). This amounts to approximately 10 percent of KSI in small overlap crashes.
- Vulnerable road user KSI account for 36 percent (STATS 19, 2015).

The hardware needed for automated steering (e.g. automated parking, steer by wire) is available and on sale, as is the vehicle support for driver initiated emergency steering. However, very few automatic steering intervention systems are currently offered. Despite challenges in market introduction and cost effective manufacturing, AES technology is expected to land into the market in the coming years. Regulation 79 is expected to permit Emergency Steering Functions (ESF) by sometime around the year 2020 (ECE/TRANS/WP.29/GRRF/82, 2016) and this will facilitate the development and fitment of AES. Euro NCAP sees possibilities to stimulate the uptake of AES technologies and verify their performance by including them in the rating scheme, based on dangerous situations with a range of road users and interactions.

As a first step, Euro NCAP plans to include driver-initiated, within-lane steering support technology in the overall rating in 2020. Information on the acceptance, robustness and performance of such systems will be gathered before taking the next step towards testing systems that may carry out more radical "avoidance by steering and braking" interventions. The timeframe for this second step will also be determined by what will be legally allowed in the future, but implementation is not expected before 2022.

Autonomous Emergency Braking (2020, 2022)

The primary goal of AEB technology is to prevent crashes by detecting a potential conflict and alerting the driver, and, in many systems, aiding in brake application or automatically applying the brakes. The technology was successfully introduced in the safety rating in 2014, and was tested first in rear-end car-to-car collisions (Schram, Williams, & van Ratingen, 2013) and subsequently in pedestrian crossing accidents (Schram, Williams, & van Ratingen, 2015). The performance of an AEB system is dependent on the type and complexity of the sensors used. More and more manufacturers are adding additional sensors and combining multiple sensor types together in "fusion" to offer the potential to address new and more complex crash scenarios.

Euro NCAP expects AEB technology to continue to evolve in the years ahead and has identified three priority areas where the rating scheme will be updated to reflect the progress in industry:

- *Back-over or reversing* crashes usually happen at low speeds at driveways and parking lots. Recent accident research by the German insurers suggests that up to 17 percent of collisions between pedestrians and vehicles with personal injury occur at the rear side of the car. The majority of accident victims (63 percent) were elderly, while children under 12 years of age accounted for 6 percent (German Insurers Accident Research, 2017). It is estimated that, Europe-wide, the number of seriously injured pedestrians in revering crashes could amount to 1,400 per year. A driver assistance system which detects the presence of persons behind the car and automatically initiates braking or prevent acceleration could have significant potential to prevent accidents involving cars and pedestrians (German Insurers Accident Research, 2010). Taking the work done by the insurance industry as a starting point (RCAR, 2017), Euro NCAP plans to adopt the reversing pedestrian scenario to the AEB Vulnerable Road User - Pedestrian test suite in 2020.
- *Crossing and turning* manoeuvres that occur at junctions create opportunities for vehicle-vehicle, vehicle-pedestrian, and vehicle-(motor)cycle conflicts, which often result in traffic crashes. Typically, crossing

[2] *STATS 19 does not codify lane departure accidents so lane departure accident were constructed by considering the following variables: Number of casualties where at least one vehicle involved was a car that performing changing lane, overtaking, going ahead in bend manoeuvres, and vehicle left the carriageway.*

accidents are the result of running a red light, lack of visibility, driver inattentiveness or speeding. Turning crashes are often caused by misjudging or failing to observe oncoming traffic when turning left or right. In crossing scenarios, where the speed of the ego vehicle is relatively low, and in turning scenarios, an AEB intervention could effectively prevent a crash. Testing could include car, pedestrian, cyclist and Powered-two-wheeler (PTW) targets and commence in 2020.

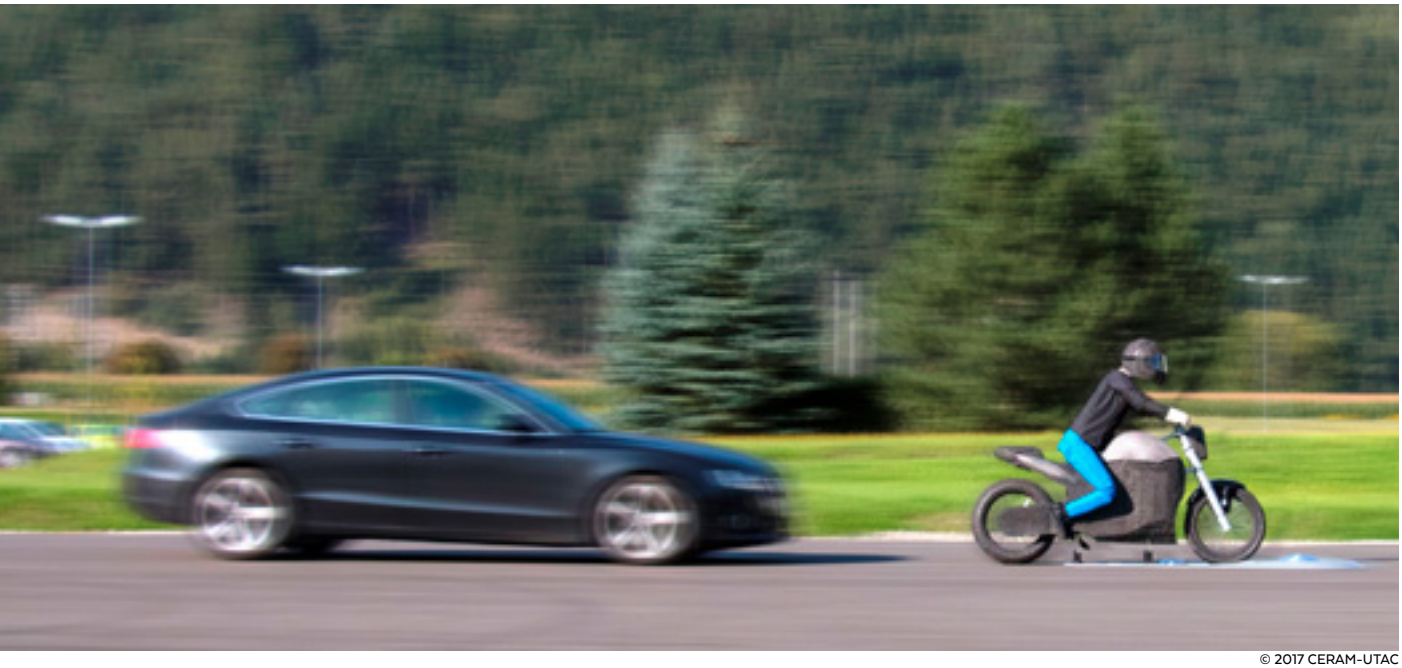
- *Head-on scenarios*. A combined assessment of steering and braking interventions within the lane to prevent narrow overlap head-on crashes with other road users (cars, PTW, pedestrians) is foreseen from 2022 (see also EAS).

V2x (2024)

V2x communication, which involves vehicles exchanging data with each other and the infrastructure, has the potential to improve traffic safety and increase the efficiency of transport. Examples of safety-related functions include the ability to transmit and receive messages like "Emergency electronic brake lights", "Motorcycle is approaching" or "Roadwork ahead". In order to provide a benefit over and beyond regular onboard sensors, V2x must identify a potential risk earlier than any of the surrounding sensors can "see" the danger. This means low latency, secure, beyond line of sight communication and localised data transfer.

In general, there are two different communications approaches being discussed to address this need: 802.11p, a standard available today and favoured by the US, and the new cellular-V2X (5G). Leading car makers, chip makers and cellular operators have established the 5G Automotive Association (5G Automotive Association, 2016) to develop, test, and promote 5G systems for automated vehicles. The European Union expects 5G services to be rolled out by 2020, though in reality it may take several more years to fully deploy the infrastructure required (European Parliament, 2017).

As long as there is uncertainty about the V2X standard and the timing, carmakers do not seem to prioritise V2X safety functions for the European market. It is expected, however, that by 2024 much of the technological uncertainty will have been resolved, leaving only the demand uncertainty. Euro NCAP recognises the safety potential of V2V and V2X technologies, for car occupants, vulnerable road users and powered two wheelers. To support the availability of technology on the vehicle side, new incentives will be introduced in the rating scheme for V2X technology that support and enhance important safety functions.



SECONDARY SAFETY

Whiplash/Rear-end Crash Protection (2020)

It is nearly ten years since Euro NCAP first introduced an assessment of the protection provided against whiplash injuries in a rear-end collision (Avery, 2008). A review has been carried out of the correlation between those ratings and real-world performance which suggests that the numbers of criteria and pulses could be reduced without significantly reducing the real-world effectiveness. Held back by the limited of progress of the Informal Group on UN Global Technical Regulation 7 (Phase II), the planned re-evaluation of the tests for 2018 is postponed to 2020. This review will also determine whether there is any justification for a higher energy test to be included in Euro NCAP.

Pedestrian and Cyclist Safety (2022)

Current pedestrian impact tests make use of the child and adult headform impactors, the upper legform impactor and the pedestrian legform impactor, FlexPLI. With the FlexPLI, injuries to the pedestrian's knee ligaments (ACL/PCL and MCL) as well as injuries to the tibia can be assessed. However, without an upper body mass representing the pedestrian's torso, the impactor does not provide any information about injuries to the femur portion of the lower extremities. Moreover, the current, linearly-guided upper legform impactor test is not truly representative of the loading that normally occurs. Two independent research studies (FlexPLI with Upper Body Mass; EC Seniors Project, Horizon2020, 2017); (aPLI; Isshiki, 2016) have shown the feasibility of replacing the current upper and lower legform tests with a revised test, using a leg impactor that represents the human leg with an upper body mass. Euro NCAP plans to adopt the most feasible procedure once it is available and proven robust, ahead of potential adoption in European Regulation.

Euro NCAP is also aiming to modify pedestrian head impactor testing to include ambient conditions relevant for cyclists as the second big group of vulnerable road users. Based on the findings of recent European research as well as the existing pedestrian protection requirements, common head test boundary conditions for pedestrians and cyclists could be derived, whereby the existing requirements are modified and two parallel test procedures are avoided. Such rearrangement of pedestrian/cyclist head form test conditions must take account of the likely benefits of avoidance technology as well as the implications for deployable bonnets.

TERTIARY SAFETY

Rescue, Extrication and Safety (2020)

Rescue services require detailed but readily-understood information regarding the construction of individual vehicles to extricate trapped occupants as quickly and safely as possible. This is becoming more pressing as vehicles become stronger (e.g. use of high strength steels or composite materials), use different sources of power (e.g. electric/hybrid, hydrogen) and are equipped with increasing numbers of safety devices (e.g. airbags, pre-tensioners). Car makers in recent years have invested in "Rescue sheets" but their availability and dissemination across Europe is not always guaranteed. Euro NCAP, in collaboration with the International Service of Fire & Rescue Services (CTIF), will support the timely availability of ISO 17840 compliant rescue sheets (ISO 17840-1:2015, 2015), consider the best options to centralise and maintain a database and have information available on the vehicle (for instance, a standardised ID tag with a link to the database).

Euro NCAP's tests and inspections already include some assessments of areas relevant to entrapment e.g. door-opening forces. The inspection procedure will be broadened to include other relevant areas such as preventing automotive entrapment and the safety of batteries or hydrogen fuel-cells and tanks.

Child Presence Detection (2022)

Leaving an unattended child in a parked car, even for a few minutes, can cause heat-stroke and death. Child deaths from vehicle-related heat-stroke happen less frequently than those resulting from crashes, but the nature of these entirely avoidable deaths deserves special attention.

A child's inability to exit the vehicle on his/her, own combined with a low tolerance for high temperatures, requires that children never be left unattended in a car. Technological solutions are available that can monitor a child's presence in the vehicle and alert the car owner or emergency services should the situation become dangerous. Euro NCAP will reward manufacturers that offer such solutions as standard.

CARRY-OVER ITEMS

The beginning of the roadmap 2025 is also the final year of the current strategic plan (Euro NCAP, 2015). Accordingly, a number of major rating updates have previously been announced to which Euro NCAP clearly stays committed. In 2020, the off-set deformable barrier test will be replaced by the mobile progressive barrier test, introducing the THOR-50M Anthropomorphic Test Device. At the same time, the side impact (AE-MDB) barrier mass and test speed will be revised and far-side protection will be added to the Adult Occupant Protection score.

Child Occupant Protection test & assessment will be brought into full alignment with Regulation 129, phasing out references to the defunct Regulation 44. Whenever available, Euro NCAP intends to adopt an improved Q10 child dummy specification to address ongoing concerns about the dummy's adult belt interaction, modifying the criteria and limits in accordance.

It is also proposed to incrementally update the assessment protocols of both Speed Assistance and Lane Support System to reflect advancements in the capabilities of systems entering the market. In the case of speed assistance systems, this includes adding incentives for system recognition of traffic signs, such as "One-way", "No entry", "Stop" or "Yield" road signs. A more stringent assessment of Lane Support Systems has already been announced, putting more emphasis on Emergency Lane Keep performance over basic Lane Keep Assist. Further revisions may include adding a Power Two-Wheeler target in the overtake scenario or testing at curved road segments.

FUTURE EVOLUTION

Technological advancements in safety will continue to accelerate and find their way into the vehicle fleet and transport system. With these innovations, new questions will arise regarding methodology and principle: E.g. how can radically different seating and restraint concepts for highly automated driving solutions be effectively evaluated and what will it mean for the long-established practices in crash testing? How can the validity and value of star ratings be guaranteed when over-the-cloud software updates become common-place for critical safety systems in cars? For this and other reasons, Euro NCAP expects to begin to review its strategic direction again in the not too distant future, probably by 2020.

3/ Automated Driving

For several years, Euro NCAP has recognised that active safety technologies can bring safety benefits, either by aiding safe driving (SAS, LSS) or by intervening to help avoid a crash if one is imminent (ESC, AEB). Technology is evolving quickly and more and more of the driving function is being handed to the vehicle. Given that around 90 percent of road accidents are attributable to driver error, the potential safety benefits of increased automation are clear assuming that the automation is at least as competent as the driver in complex traffic situations. It is therefore in Euro NCAP's interests to raise awareness of the technologies that exist among consumers 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.

THE ROLE OF EURO NCAP

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.
- Clearly identify functionality and encourage commercial unambiguous labelling.
- Develop protocols to assess safe automation in terms of technical performance and driver vehicle interaction.
- Ensure that safety remains a factor in consumers' purchasing decisions when it comes to automated driving technologies.
- While at the same time;
- Promote automated driving technologies and raise awareness of their safety benefits and performance limitations.

AUTOMATED FUNCTIONALITIES

The development of passenger car automation is likely to be rapid but evolutionary. No car yet offers complete automation in all situations and driving environments. However, early examples of Level 3 automation, allowing the driver to disengage from the driving task in defined situations, are entering the market.

The main characteristic of current functions is the simultaneous automation of longitudinal and lateral control but these still require the driver to oversee their safe operation. 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 is to be assessed separately. This would allow consumers to compare the results of one vehicle with those of another in the same driving situation and ensure correct system use. The following is a list of use cases for which some degree of assistance or automation function is offered, or expected to be offered soon, and in which Euro NCAP may have an interest:

- Parking
- City driving
- Inter-Urban driving
- Traffic Jam
- Highway driving

In some use-cases, automation can offer greater safety benefits than in others. In the future, there may be good reason to combine the assessments of individual functionalities into a combined 'Automated Driving' rating. This would weigh the results of individual functionalities by the relative safety relevance.

TESTING AND ASSESSMENT

Euro NCAP is, and will remain, dedicated to the promotion of safer vehicles by providing relevant consumer information. To this end, Euro NCAP aims to test the performance of a system and, to some extent, assess the driver-vehicle interaction.

Consumer information about Automated Driving systems must be based on transparent, objective and non-discriminatory criteria and the independent testing of the technology. Therefore, specific test and assessment procedures for safe Automated Driving in terms of technical performance as well as Human Machine Interaction (HMI) have to be developed.

Given that the first systems will already enter the market before test procedures can be completed, Euro NCAP

will focus firstly on informing consumers on the functionality, technical limitations and HMI of these systems. This means it aims to provide explanatory information covering some of the following items: Definition (e.g. manual, branding), System Enable, System Activation (e.g. with ACC), Operation (functional testing of principle system functionality such as AEB, SAS, etc.), Driver deactivation (e.g. considered manoeuvre, like switch, brake or steer), Drop out (automatic deactivation e.g. at end of road markings), Override (instantaneous driver takeover, e.g. emergency cases).

In addition, regarding successful HMI, Euro NCAP will examine drivers' expectations and comprehension based on manufacturer's information as well as the behaviour of the system itself, to ensure a safe and intended use. For the first time, a dual way of interaction-assessment will be carried out pragmatically, integrating not only experts' technical testing but also information from user studies in the assessment process. For this purpose, standardized protocols and procedures for expert and user assessments will be developed soon.

GRADATION

For the time being, the assessment of automated driving will be kept separate from Euro NCAP's mainstream star rating scheme. A separate gradation scheme is proposed, with simple, descriptive levels of the degree and safety of the system. Euro NCAP plans for a phased-in approach that will focus first on Continued Assistance systems, particularly the Highway and Traffic Jam Assistants. This will probably start ahead of the roadmap term, or as early as 2018/2019.

4/ Other Initiatives

TRUCK LABEL

In 2011, in the EU-27, there were 4,252 fatalities from collisions involving Heavy Goods Vehicles (HGV) with a weight over 3.5 tonnes. This represents 18 percent of the 27,000 people killed in road accidents in Europe that year (Wismans, 2016). The largest proportion of HGV-related casualties was car occupants impacting a truck, crashes that occur mostly in rural areas. This was followed by accidents with vulnerable road users, 60 percent of which occur in urban areas. Truck occupants represent the lowest proportion of fatalities.

Trucks represent around five percent of registered vehicles and are involved in around four percent of all injury accidents but around 15 percent of fatal road accidents. This shows that they are no more likely to become involved in a collision than other vehicle types but when they do, the collision is far more likely to cause a fatality. Therefore, trucks have a disproportionately negative effect on road safety. This excessive impact is linked to their size, weight and the way they are designed. Because of a high seating position and their vehicles' brick-shaped cabs, truck drivers have a very poor field of view. In particular, in built-up areas, this leads to blind spot accidents and when crashes occur, vulnerable road users are often run over by the wheels.

Opportunities are being discussed to use traditional and emerging technologies to promote the safety of vehicles other than passenger cars. A recent ACEA report (Wismans, 2016) has identified the following as effective countermeasures that would provide cost-benefit: emergency braking systems that can detect cars and VRUs; extended flexible front under-run protection; lane-keeping support and visibility support (aimed at reducing blind spots); and speed assistance systems. The question is why these technologies have remained relatively uncommon across the HGV fleet in Europe and how that situation could be changed.

A dedicated truck label would be a stand-alone instrument targeting a new category of vehicles not covered by a safety rating. The label would:

- Accelerate the market penetration and reduce the cost of safer vehicles and technologies by creating scale required for mass-market penetration. With this approach the demand across Europe will be extended so that it will be commercially attractive to vehicle manufacturers to implement safety systems. It will also improve competitiveness between producers and encourage them to build trucks that are safer than their competitors;
- Enable more authorities and operators to make use of and scale up urban truck safety schemes by reducing administrative barriers;
- Reduce the administrative burden for companies operating in and between different European cities (that currently may have different requirements);
- Complement and reinforce regulatory efforts such as the General Safety Regulation or UNECE processes.

Euro NCAP will support, but not necessarily lead, the technical development of such a label for cities as well as highways, based on the experience it has gained with testing and rating of different safety technologies.

POWERED TWO WHEELERS

Over the last decades, motorcycles and mopeds have gained significant popularity in European cities. Riding a powered-two-wheeler offers an attractive alternative to private car ownership because it is generally is less expensive and has advantages in terms of parking and mobility in dense traffic. Compared to cars, however, powered-two-wheelers are more vulnerable and they are involved in a disproportionately high percentage of fatal and serious crashes. Moreover, the safety of powered-two-wheelers has not improved nearly as much as that of passenger cars.

Technologies such as anti-lock braking, electronic stability control, traction control and other safety related equipment that would help to improve the situation for powered-two-wheelers have been available for years, but are often limited to high-end, expensive motorcycles. Powered-two-wheeler safety is an urgent problem that requires closer collaboration between the car and motorcycle industries and more awareness amongst riders about the potential benefits of the latest safety innovations.

Euro NCAP's first and foremost role is to help address the powered-two-wheeler situation by promoting passenger car solutions. Last year, new initiatives were started to study the type of crashes that the motorcyclists are in-

volved in, to evaluate the most suitable ADAS systems to avoid these kinds of crashes and to develop the test equipment and procedures to assess the system performance. The outcome of this research will be used to facilitate the rating scheme updates (AEB, see page 8).

Motorcycle manufacturers themselves see considerable potential in Intelligent Transport Systems (ITS) , which are specifically designed for powered-two-wheeler riders and in those that seek to protect riders, by giving them a digital presence with surrounding vehicles, and which can inform and warn the other vehicle drivers by means of an appropriate HMI of the oncoming motorcycle. The Connected Motorcycle Consortium (Connected Motorcycle Consortium, 2014) was set up to create a common approach for ITS on powered-two-wheelers and achieve successful implementation and deployment of ITS functions. Also on this subject, Euro NCAP intends to support technology adoption on the side of the vehicle (V2X, see page 7).

CYBER SECURITY

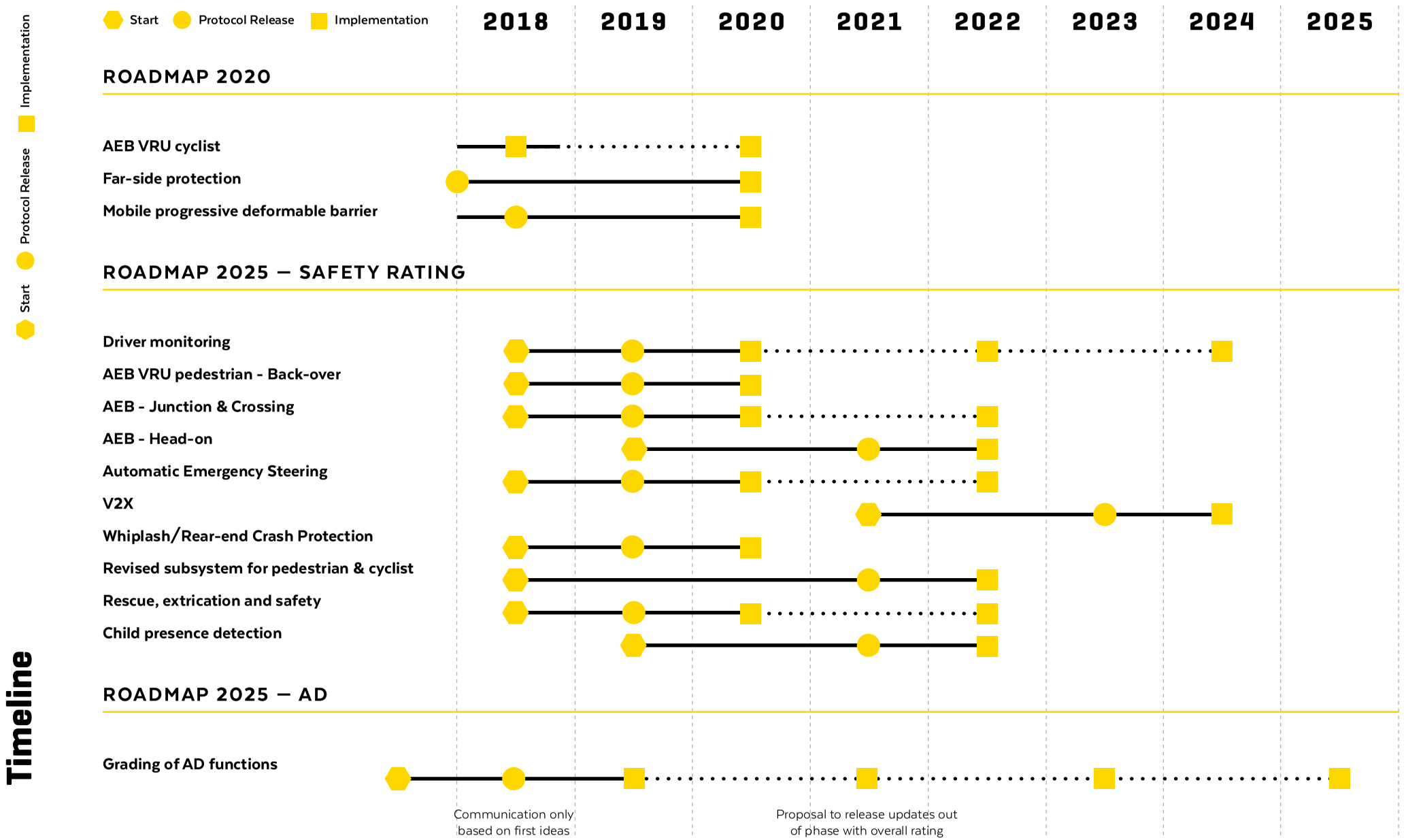
As cars become increasingly connected and depend more and more on the exchange of data over the internet, so they become more vulnerable to hacking and cyber-attack. Cases have already been reported of some vehicle controls being remotely manipulated and there is increasing concern that this weakness could be exploited maliciously to jeopardise safety. In other words: a system that is not secure is not safe.

Cyber-Security is not, per se, of direct relevance to Euro NCAP. However, technologies may emerge that offer a safety benefit and Euro NCAP may reward these, thereby advising consumers that vehicles will be safer for having such systems. If it transpires that these systems are easily attacked in a way that undermines their safety, trust in Euro NCAP's rating could also be undermined.

Work is ongoing to develop a revision of ISO 26262 (Automotive Functional Safety) and a joint working group between ISO (21434) and SAE (J3061) has started the development of an Automotive Cyber-Security Standard. This will provide a Cyber-Security process framework and help companies design security into cyber-physical vehicle systems throughout the entire development lifecycle process. At the same time, the topic is discussed by the UN Task Force on Cyber Security and OTA issues, under Umbrella of WP29/ITS-AD group (Informal Working Group on Intelligent Transport Systems-Automated Driving (ITS/AD), 2017).

Euro NCAP will continue to monitor how these standards and regulations develop and how the industry is responding. Through compliance with these existing standards, Euro NCAP may require a minimum level of Cyber-Security be demonstrated by the vehicle manufacturer.

Timeline


Start
Protocol Release
Implementation
2018
2019
2020
2021
2022
2023
2024
2025
ROADMAP 2020
AEB VRU cyclist
Far-side protection
Mobile progressive deformable barrier
ROADMAP 2025 – SAFETY RATING
Driver monitoring
AEB VRU pedestrian - Back-over
AEB - Junction & Crossing
AEB - Head-on
Automatic Emergency Steering
V2X
Whiplash/Rear-end Crash Protection
Revised subsystem for pedestrian & cyclist
Rescue, extrication and safety
Child presence detection
ROADMAP 2025 – AD
Grading of AD functions
Communication only based on first ideas
Proposal to release updates out of phase with overall rating

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