

DOORING

TOPICS

- NEW TEST CRITERIA 2023
- EURO NCAP DOORING SCENARIO
- ADAS
- EXIT ASSISTANCE
- MAIN CAUSE OF VRU FATALITIES



MAIN CAUSE

OF FATALITIES

A look at the statistics of the past years shows quite impressively that a large number of accidents and fatalities in the area of VRU (Vulnerable Road User) could be prevented with little effort. In Europe, 48%¹ of fatalities in road accidents are VRUs. Every second bicycle accident associated with parked cars is caused by so-called "dooring."² The aim of "Exit Assistance" is to counteract these accidents. What this is and why it generates new test scenarios such as Euro NCAP "Car-to-Bicyclist Dooring Adult (CBDA)" is discussed in this whitepaper.

¹ As at 2018 | Source: Global Status Report On Road Safety, World Health Organization 2018 (ISBN 978-92-4-156568-4)

² Source: Dutch Reach Project



THE CHALLENGE

NEW TEST SCENARIOS

A study from 2020 shows that 18% of all accidents with injured people are related to dooring. Dooring means that an occupant of a motorized vehicle opens their door into the lane of another traffic participant. There are two strategies to significantly decrease the number of dooring accidents in road traffic. The first is to generally counteract dooring by increasing awareness and using the so-called "Dutch method." This method requires the occupant of the vehicle to open their door with the opposite hand. This physically turns the body already in the direction of the possibly oncoming VRU. Second, the number of accidents is to be significantly reduced by a new ADAS (Advanced Driver Assistance System) "Exit Assistance." This new system needs to be tested, validated and qualified within Euro NCAP for vehicle comparability.



QUALIFICATION

ACCORDING TO EURO NCAP – CBDA SCENARIO

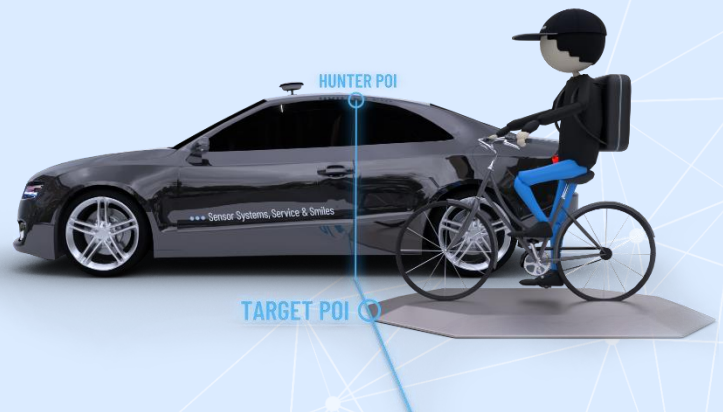
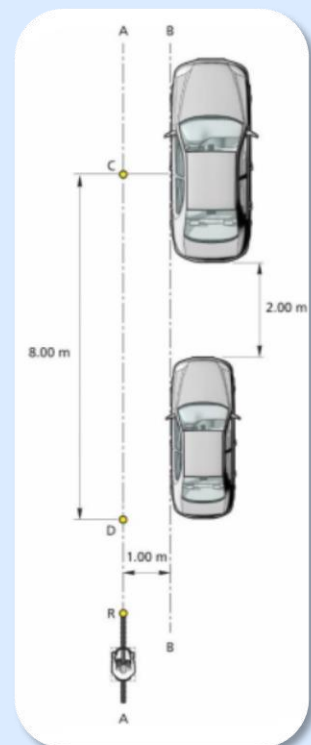
EURO NCAP will assert changes in vehicle evaluation processes for VRU protection starting in 2023. This introduces a scenario that checks "Exit Assistance" and determines if the vehicle detects the approaching VRU and warns the occupant or even temporarily locks the door if the door opens when the VRU is approaching. This test is said to account for 11% of the vehicle score in the area of VRU safety, making it an important module for automotive manufacturers to perform better in this area compared to competitors. The Euro NCAP guideline awards points for detecting the VRU, for a visual and auditory or haptic warning signal, and for temporarily securing the door. If this system is active for all vehicle doors, full points are awarded.



ACCURACY REQUIREMENTS

FOR EURO NCAP CBDA SCENARIOS

In these test scenarios, the VRU and vehicle must be located so that it can be checked when the vehicle reacts to the scenario and how. For the implementation of the CBDA scenarios, the Euro NCAP has clear specifications that must be fulfilled by the measuring equipment used. The deployed inertial systems, for example, must guarantee measurement accuracies of ± 0.1 km/h for VUT and EBT velocities, ± 3 cm for longitudinal and lateral positions, $\pm 0.1^\circ$ for the VUT heading, or $\pm 0.1^\circ/\text{s}$ for yaw rate. Time to Collision (TTC) must also be determined using the Hunter and Target reference points shown below. The cyclist must accelerate to 15 km/h and move toward the parked Hunter vehicle with a lateral offset from the reference point on the vehicle door of 1.00 m. When the cyclist is $8\text{ m} \pm 0.5\text{ m}$ from the door reference point, the occupant manually operates the door opener. It is now checked to see how the "Exit Assistance" reacts to the approaching cyclist. This can be done using a camera system and lane markings, auditory sensor and a contact switch.



POSSIBLE MEASUREMENT EQUIPMENT

ACCORDING TO THE REQUIREMENTS

With the aid of the inertial system ADMA, the positions of individual traffic participants can be determined to an accuracy within $1\text{ cm } 1\sigma$, speeds to 0.03 km/h RMS , and pitch, roll and yaw angles to within $0.015^\circ 1\sigma$. In addition, relative data between the Hunter and the Target can be calculated already in the platform itself using a software add-on with regard to arbitrarily definable so-called "points of interests," and the lateral offset can be determined between the parked vehicle and the VRU. Signal IN inputs allow analog signals from camera, audio sensor and digital triggers from contact switches to be fed to the ADMA and synchronized with the measurement data. This allows the test scenarios to be evaluated in real time with a latency of between 10 and 45 milliseconds, thereby fulfilling all Euro NCAP criteria and requirements. These test scenarios are performed nowadays with overrunable platforms, and the GeneSys inertial systems ADMA can be integrated with all well-known manufacturers for traversable platforms and driving robots. ADMAs are also characterized by short initialization processes and long-term stability under prolonged static conditions, which plays a major role in these test scenarios, especially for the validation during development.



CONCLUSION

RECOMMENDATION

When it comes to planning and integrating the development, validation and qualification of the new ADAS "Exit Assistance," we recommend using GNSS-based inertial systems. These provide a strong basis to perform all tests during the development phase, every validation drive at release, and all qualification scenarios prescribed by external parties. The wide range of applications for inertial platforms has made them a standard measurement tool in the automotive and vehicle industries throughout ADAS, vehicle dynamics, functional safety, ground truth, vehicle-in-the-loop, and many more. The ADMA will not only be applied in the development of "Exit Assistance," but also in many other areas and is therefore a sustainable acquisition.



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