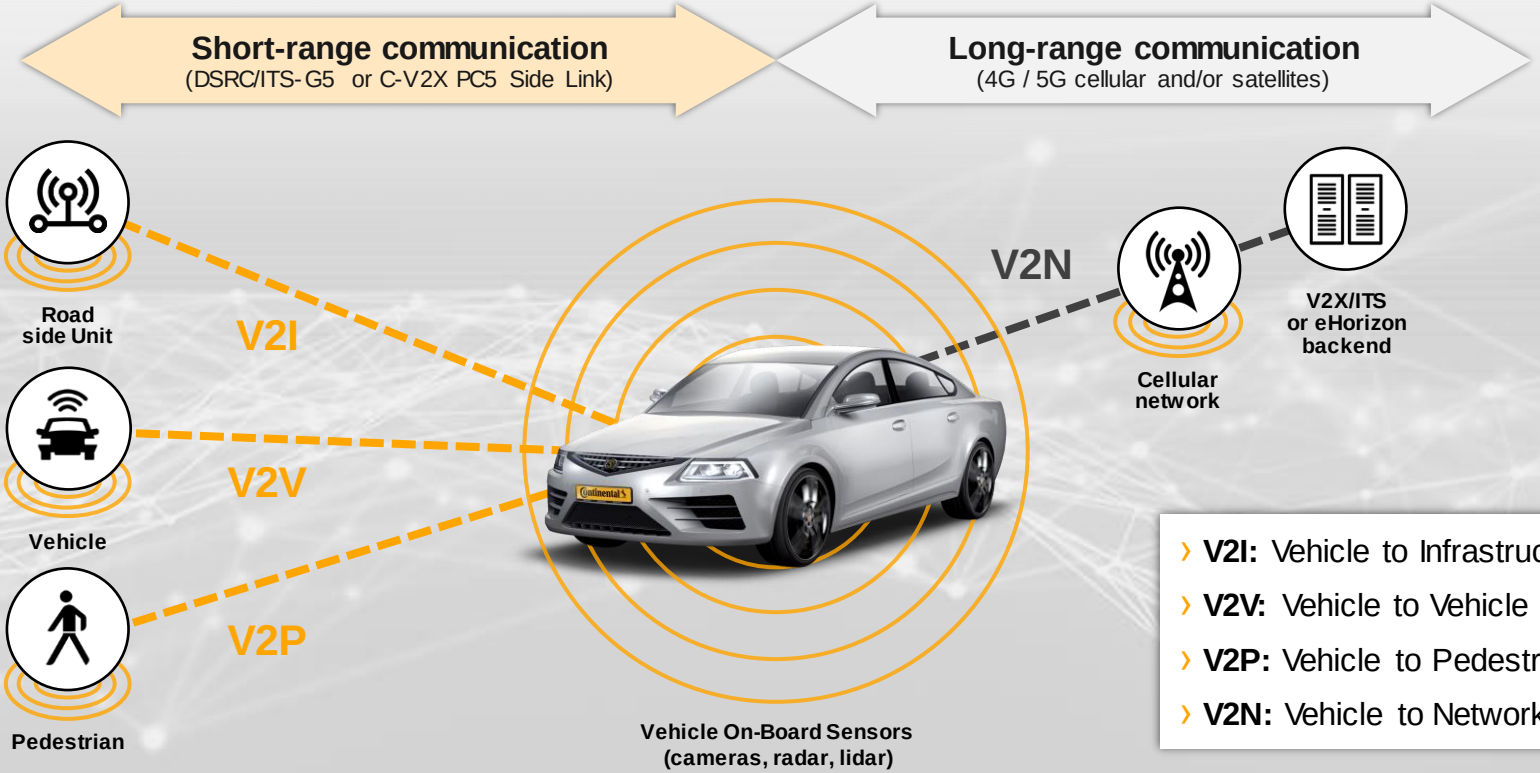
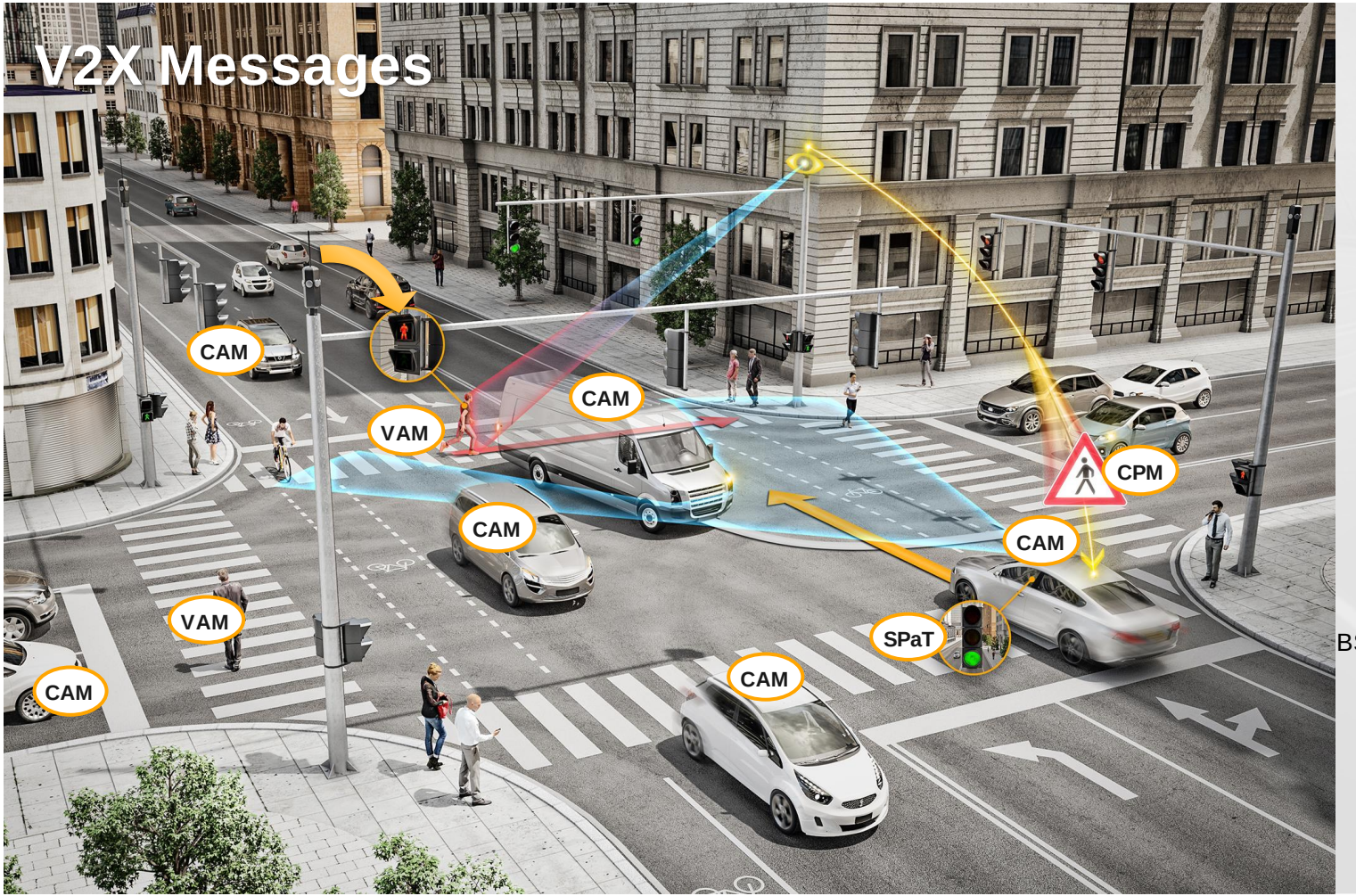
Importance of Collective Perception, V2X spectrum needs, expectation on Euro NCAP

Bettina Erdem, regulatory affairs V2X

V2X
Multiple Communication Schemes



V2X Messages



CPM

Collective Perception Message or SDSM – Sensor Data Sharing Message

SPaT

Signal Phase and Time of Traffic Lights

CAM

CAM – Cooperative Awareness Message or BSM – Basic Safety Message

VAM

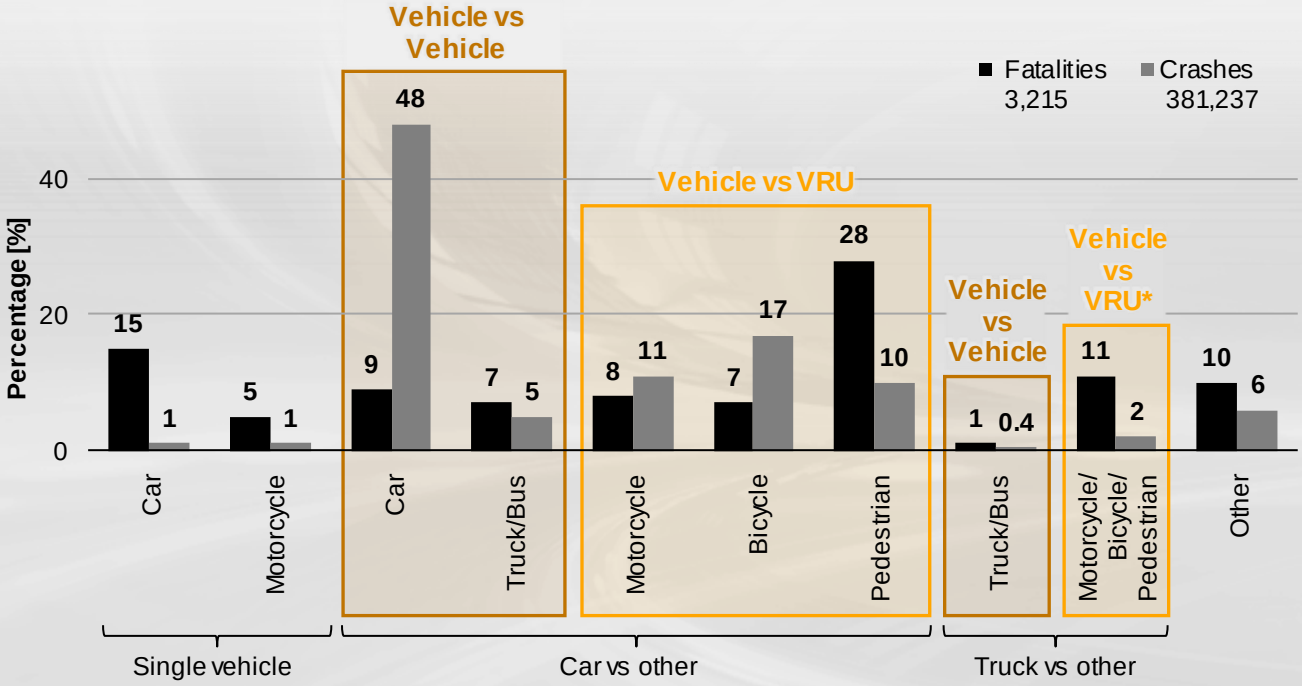
VAM – VRU awareness message or PSM – Personal Safety Message

Protecting non-V2X Vehicles and Vulnerable Road Users (VRUs)

- During the V2X introduction, many vehicles will not have V2X yet, and cannot be protected by Basic V2X – for instance, CAM or BSM V2V – messages
- VRUs, who also do not transmit or receive V2X messages yet, are also not addressed

We need a way to accelerate the benefits to save more lives in these early decades

Japan Traffic Crashes



Vehicle vs Vehicle:
- 537 fatalities
- 201,766 crashes

Vehicle vs VRU*:
- 1,706 fatalities
- 147,690 crashes

*Vulnerable Road Users

54% of all fatalities in Japan involve Vulnerable Road Users

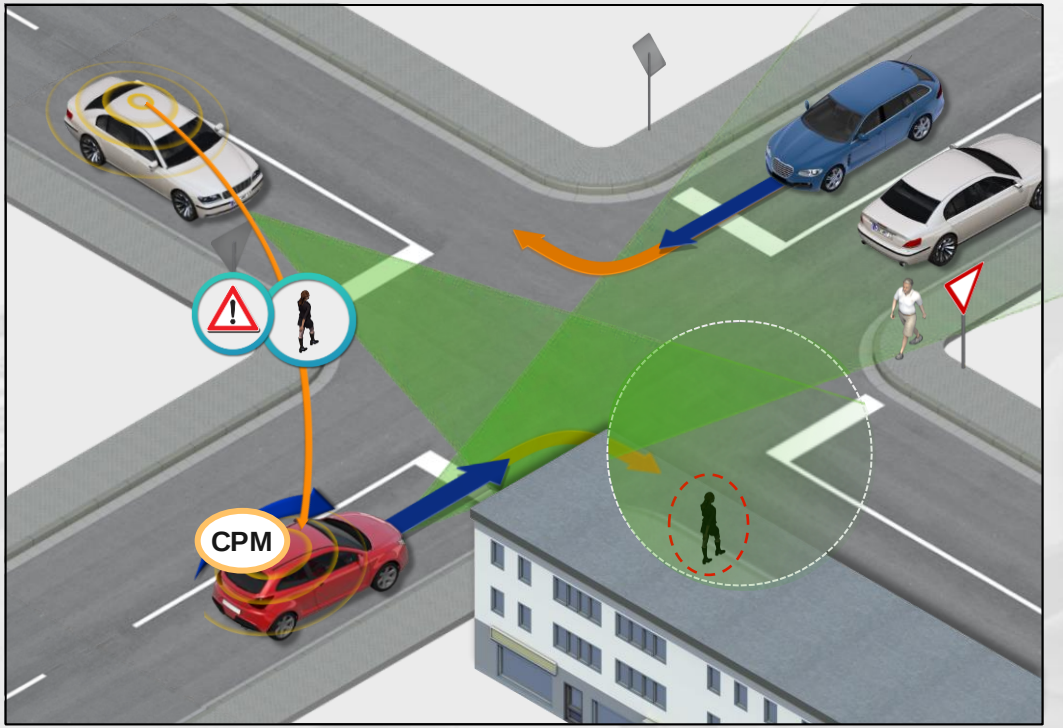
Collective Perception Messages

”Seeing through the Eyes of Others”

Collective Perception Messages
→ Protect VRUs

Using vehicle-to-vehicle communication in cities and at intersections:

- The white car detects the hidden pedestrian
- The white car sends information about the pedestrian to the red car
- The red car can warn the driver about the pedestrian
- V2V with CPM can leverage the different perspectives from each of the traffic participants to provide a more complete environmental view



Collective Perception Messages

”Smart Intersection for VRU Protection”

Collective Perception Messages
→ Protect VRUs

Using vehicle-to-infrastructure communication to make intersections safer:

- Intelligent infrastructure uses its sensors, such as camera or radar, to detect VRUs
- The intelligent infrastructure transmits position and movement information of the VRUs
- V2I with CPM can protect VRUs even when no other vehicles are present

Smart Intersections with CPM can convert accident hotspots into safety zones for V2X vehicles

Smart intersection & CPM sending vehicles are the only available technology to protect VRU in NLOS situations

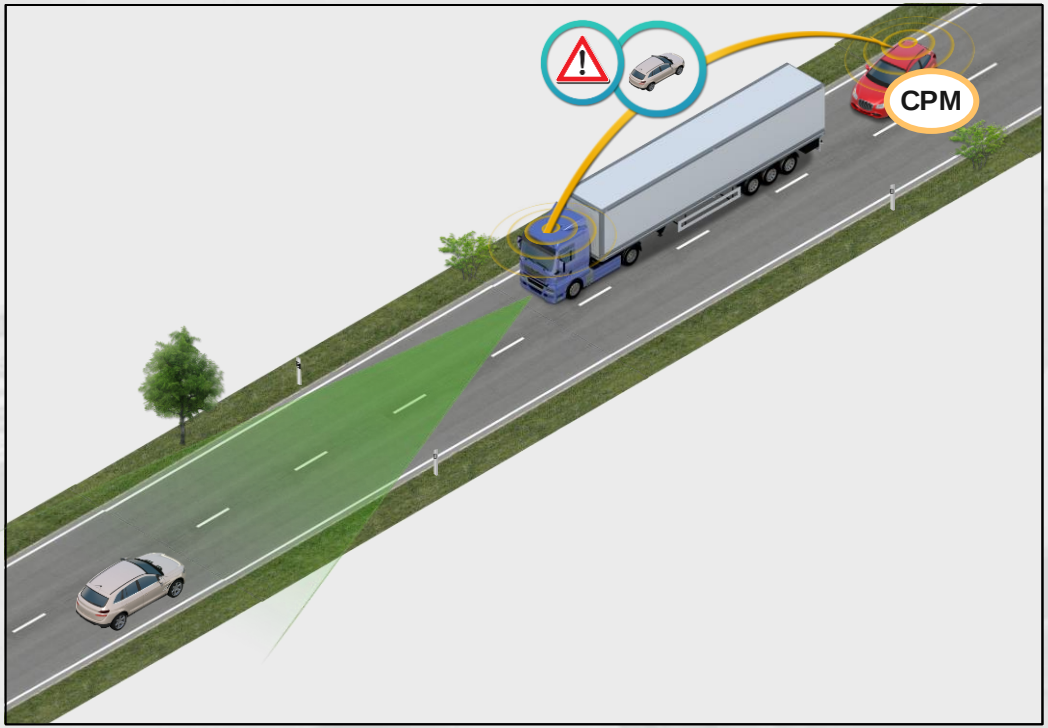
Collective Perception Messages

”Protect the Non-connected Vehicles”

Collective Perception Messages
→ Protect non-connected vehicles

Using vehicle-to-vehicle communication on open roadways:

- The truck detects the oncoming white car with its sensors
- The white car is non-connected (no V2X)
- The truck uses V2V CPM to provide the information to the red vehicle
- The red vehicle can warn its driver not to try to pass the truck at this time
- V2V with CPM can protect vehicles even in less-crowded areas, such as open roads



Protecting VRUs: “V2X-enhanced ADAS”

Maximizing VRU Protection
→ By combining different technologies

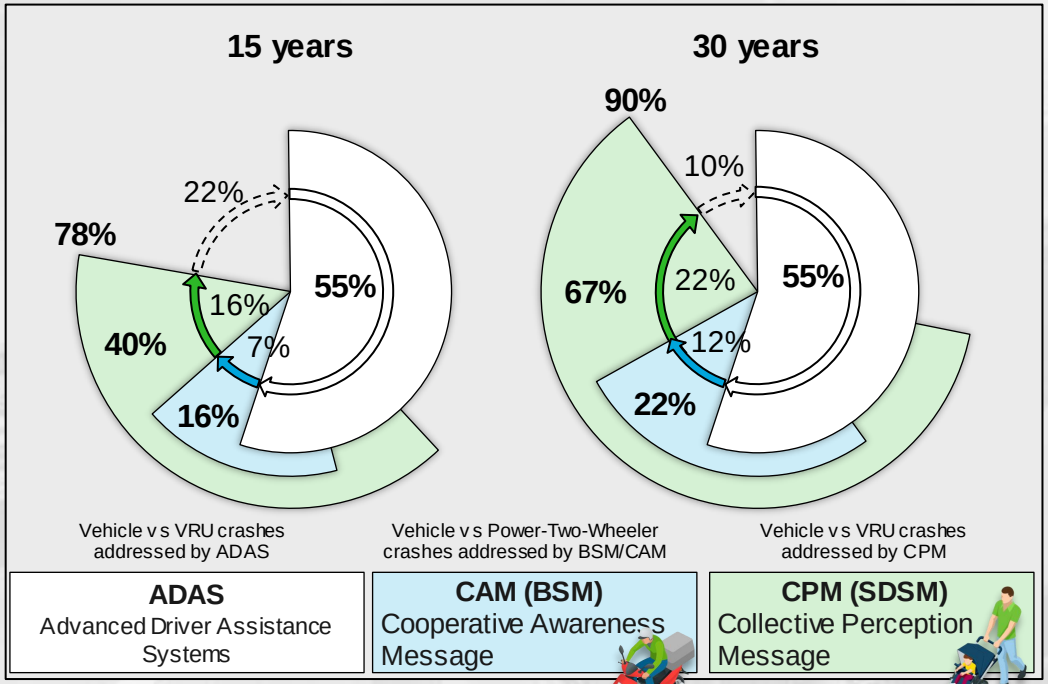
Mid-Term (15 years):

- On-board Advanced Driver Assistance Systems sensors (camera/radar/lidar) protect of VRUs 55%
- CAM alone protects about 16%
- ADAS, CAM and CPM can protect of VRUs **78%**

Long-Term (30 years):

- ADAS protects 55%
- CAM protects Power-Two-Wheeler 22%
- ADAS, CAM, and CPM in combination can protect of VRUs **90%**

Vehicle vs VRU crashes in Japan
1,706 fatalities, 147,690 crashes



CPM can close the safety gap for Vulnerable Road Users

V2X Spectrum Needs in 5.9 GHz in MHz

V2X implementation phases		V2X messages acc. to SAE and ETSI	Urban	Suburban	Highway
1. Phase	Awareness driving	CAM (or BSM), DENM, SPaT, MAP, IVIM, VAM (or PSM)	14	12	12
2. Phase	Sensing driving	CPM for "Collective Perception" (or SDSM) 	23	26	24
3. Phase	**Cooperative automated driving**	PCM for "platooning", MCM for "Maneuver Coordination"	26	32	34
		= Total needed V2X bandwidth in 5.9 GHz	**63 MHz**	**70 MHz**	**70 MHz**
3. Phase	Cooperative automated driving	+ critical communication needs extra redundant spectrum in **760 MHz**	**+ 9 MHz**	**+ 9 MHz**	**+ 9 MHz**

- **V2X needs 70 MHz in 5.9 GHz plus 9 MHz in 760 MHz spectrum band for Cooperative Automated Driving and Vulnerable Road User protection**

Source: C2C-CC position paper on "Road Safety and Road Efficiency Spectrum Needs in the 5.9 GHz for C-ITS and Cooperative Automated Driving" see page 19, 21 and Annex

Short range V2X communication: 70 MHz in 5.9 GHz Radio Spectrum is required

- Short range communication is relevant to address vehicle vs vehicle and vehicle vs. VRU crahes.
  - Democratize safety for all
    - Low operational costs
    - Independent of a network
    - Safety everywhere (urban, rural, highway)
    - at all times - under traffic congestion - even in a catastrophe
    - All driving scenarios
  - Appropriate: Low latency, high reliability
    - Step vise: driver warning / integrate V2X as an additional sensor into ADAS / enable emergency braking
    - Basis to build cooperative automated driving
  - 5.9 GHz Radio Spectrum is appropriate to broadcast V2X messages (like CAM/BSM, CPM/SDSM, MCM) several times per second ALWAYS to all neighboring vehicles and VRU in relevant range: standardized, interoperable, available for all.

Summary

Continental has been shipping Telematics systems for 25 years, and we think in a very practical way

› Our goal is to find ways to save lives as soon as possible

But we need to also protect 2 key groups:

1. Vulnerable Road Users (VRU) (pedestrians, bicycles, and motorcycles), and
2. vehicles that do not yet have V2X

!

There is a solution

› Collective Perception is being standardized and considered by Vehicle Manufacturers for shipments starting in 2025 / 2026

Collective Perception with Advanced Driver Assistance Systems (ADAS) and Basic V2X can address 78% of vehicle-vs-VRU crashes in 15 years, and 90% of vehicle-vs-VRU crashes in 30 years

Calls to Action

› Planning and allocating the spectrum now is critical to enable this life-saving Collective Perception function – World Radio Conference recommendation is for globally-harmonized 70 MHz total in 5.9 GHz

› Adding Collective Perception to intelligent infrastructure will provide an even greater boost by protecting dangerous and crowded intersections

Euro NCAP Introduction

What is Euro NCAP?

New Car Assessment Programme

…Formation in 1997

…an independent consumer testing organization → no legislator!

…goal is a higher level of road safety

…conducts vehicle safety assessments and provides consumers with comprehensible ratings

…is an influential stakeholder for vehicle safety for the whole automotive industry

Euro NCAP

Comparison of Type-Approval vs. Consumer Rating

Type Approval / Homologation

§ § §

Approved ✓

Not approved ✗

Market access is ensured by fulfilling minimum technical requirements

Consumer Rating

★★★★★	Overall excellent performance in crash protection and robust crash avoidance technology
★★★★☆	Overall good performance in crash protection and additional crash avoidance technology
★★★☆☆	At least average occupant protection and not always equipped with the latest crash avoidance technology
★★☆☆☆	Nominal crash protection but not actual crash avoidance technology
★☆☆☆☆	Marginal crash protection and minimal crash avoidance technology
☆☆☆☆☆	Meeting type-approval standards, lacking modern safety technology

System performance is steadily increased by a continuous adaption of the rating scheme

Euro NCAP outlook, roadmap 2030

Source in chart 11: C2C-CC position paper on “Road Safety and Road Efficiency Spectrum Needs in the 5.9 GHz for C-ITS and Cooperative Automated Driving” see https://www.car-2-car.org/fileadmin/documents/General_Documents/C2CCC_TR_2050_Spectrum_Needs.pdf

Source chart 10: Continental study and Continental paper on ITS WC 2021 in Hamburg “Reducing Traffic Fatalities using Collective Perception in V2X, Communication based on Crash Data in Japan/Germany/US”

Thank you for your attention

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