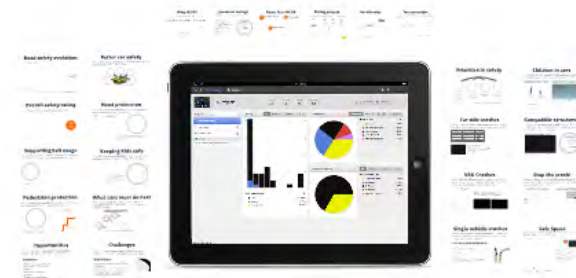




# How Consumer Ratings Drive Vehicle Safety Improvements

Michiel van Ratingen - Euro NCAP



UNIE VAN DE BELGISCHE INGENIEURS IN DE AUTOTECHNIEK vzw  
UNION BELGE DES INGENIEURS DE L'AUTOMOBILE ASBL



# How Consumer Ratings Drive Vehicle Safety Improvements

Michiel van Ratingen - Euro NCAP





The Official Site of The European  
New Car Assessment Programme

## LATEST SAFETY RATINGS



2016 ★★★★★

**Peugeot 3008**

Standard safety equipment



2016 ★★★★★

**Renault Scenic**

Standard safety equipment



2016 ★★★★★

**Subaru Levorg**

Standard safety equipment



# Why NCAP?

A closer look at the European Whole Vehicle Type Approval ...

## ➔ Legal requirements

European Whole Vehicle Type Approval Number

## ➔ UN/ECE Regulations

1	Sound levels	70/157/EEC	21	Locking devices	77/88/EEC
2	Orbitals	70/280/EEC	22	Passing devices	77/88/EEC
3	Passive seat belt protective devices	70/221/EEC	23	Reversing lamps	77/88/EEC
4	Front suspension guide rails	70/222/EEC	24	Working lamps	77/88/EEC
5	Steering effort	70/411/EEC	25	Seat belts and head restraints	77/88/EEC
6	Lower ball joints and hinges	70/422/EEC	26	Forward vision	77/88/EEC
7	Frontal airbrake	70/680/EEC	27	Forward vision	77/88/EEC
8	Devices for reduced speed	71/71/EEC	28	Marking of electrical circuits	70/242/EEC
9	Braking	71/541/EEC	29	Delocalisation	70/242/EEC
10	Mass/centre of gravity interference	72/642/EEC	30	Wheel covers	70/242/EEC
11	Sound levels	68/96/EEC	31	Locking systems	80/116/EEC
12	Frontal lighting	76/762/EEC	32	Wheel guards	70/156/EEC
13	Anti-theft and immobiliser	76/762/EEC	33	Head restraints	70/156/EEC
14	Production marking	76/212/EEC	34	CO2 emissions/fuel consumption	80/116/EEC
15	Seat strength	70/480/EEC	35	Engine power	80/116/EEC
16	Collision protection	70/480/EEC	36	Brake emissions	80/116/EEC
17	Speedometer and odometer gear	70/480/EEC	37	Exhaust and emissions (gmp)	80/116/EEC
18	Power (category)	70/116/EEC	38	Lighting gear	80/116/EEC
19	Seat belt anchorage	70/116/EEC	39	Type	80/116/EEC
20	Headlamps (lighting and light signalling devices)	76/762/EEC	40	Control devices	80/116/EEC
21	Interference	76/762/EEC	41	Service and emergency (power transmission) devices	80/116/EEC
22	Headlamps (beam characteristics, visibility time curve)	76/762/EEC	42	Locking	80/116/EEC
23	Headlamps (beam characteristics, visibility time curve)	76/762/EEC	43	Visibility	80/116/EEC
24	Intermittent wipers	76/762/EEC	44	Electric and lighting	80/116/EEC
25	Front suspension guide rails	70/411/EEC	45	Electric and lighting	80/116/EEC
26	Front suspension guide rails	70/411/EEC	46	Electric and lighting	80/116/EEC
27	Front suspension guide rails	70/411/EEC	47	Electric and lighting	80/116/EEC
28	Front suspension guide rails	70/411/EEC	48	Electric and lighting	80/116/EEC
29	Front suspension guide rails	70/411/EEC	49	Electric and lighting	80/116/EEC

## ➔ Type Approval testing

Type-approval tests are performed by technical services and approvals are issued by approval authorities.

### Type Approval does:

- Provide minimum requirements for functionality
- Ensure baseline performance, including safety performance, for all cars



### Type Approval does not:

- Provide any consumer information or choice
- Encourage best practice and higher performance
- Reward excellence by manufacturers





# Legal requirements

European Whole Vehicle  
Type Approval Number



AUDI AG

e1\*2007/46\*0436

WAUZZZ4G0EN083431

2270 kg

4150 kg

1 - 1130 kg

2 - 1265 kg

Typ 4G



Audi

03  
CGLC7031

0,50 112013





# UN/ECE Regulations

1	Sound levels	70/157/EEC	27	Towing hooks	77/389/EEC
2	Emissions	70/220/EEC	28	Rear fog lamps	77/538/EEC
3	Fuel tanks/rear protective devices	70/221/EEC	29	Reversing lamps	77/539/EEC
4	Rear registration plate space	70/222/EEC	30	Parking lamps	77/540/EEC
5	Steering effort	70/311/EEC	31	Seat belts and restraint systems	77/541/EEC
6	Door latches and hinges	70/387/EEC	32	Forward vision	77/649/EEC
7	Audible warning	70/388/EEC	33	Identification of controls	78/316/EEC
8	Devices for indirect vision	71/127/EEC	34	Defrost/demist	78/317/EEC
9	Braking	71/320/EEC	35	Wash/wipe	78/318/EEC
10	Suppression of radio interference	72/245/EEC	36	Heating systems	2001/56/EC
11	Diesel smoke	72/306/EEC	37	Wheel guards	78/549/EEC
12	Interior fittings	74/60/EEC	38	Head restraints	78/932/EEC
13	Anti-theft and immobiliser	74/61/EEC	39	CO2 emissions/fuel consumption	80/1268/EEC
14	Protective steering	74/297/EEC	40	Engine power	80/1269/EEC
15	Seat strength	74/408/EEC	41	Diesel emissions	88/77/EEC
16	Exterior projections	74/483/EEC	44	Masses and dimensions (cars)	92/21/EEC
17	Speedometer and reverse gear	75/443/EEC	45	Safety glass	92/22/EEC
18	Plates (statutory)	76/114/EEC	46	Tyres	92/23/EEC
19	Seat belt anchorages	76/115/EEC	47	Speed limiters	92/24/EEC
20	Installation of lighting and light signalling devices	76/756/EEC	48	Masses and dimensions (other than vehicles referred to)	97/27/EC
21	Retro reflectors	76/757/EEC	50	Couplings	94/20/EC
22	End-outline, front-side, rear-side, stop, day time running	76/758/EEC	51	Flammability	95/28/EC
23	Direction indicators	76/759/EEC	52	Buses and coaches	2001/85/EC
24	Rear registration plate lamps	76/760/EEC	53	Front impact	96/79/EC
25	Head lamps (including bulbs)	76/761/EEC	54	Side impact	96/27/EC
26	Front fog lamps	76/762/EEC	58	Pedestrian protection	2003/102/EC



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# Consumer ratings

Consumer testing complements Type Approval

- Independent
- Non-regulatory / voluntary
- Safety tests only
- Tougher tests than legislation
- Additional tests
- Directed at consumers
- Allow comparison between vehicles
- Promote competition
- Rewarding innovation



# Creating a market for safety



New technology



Safer Designs,  
Better Fitment

Consumer information



Consumer choice



Manufacturer competition



# About Euro NCAP

**12**  
members

## Collaborating for safety

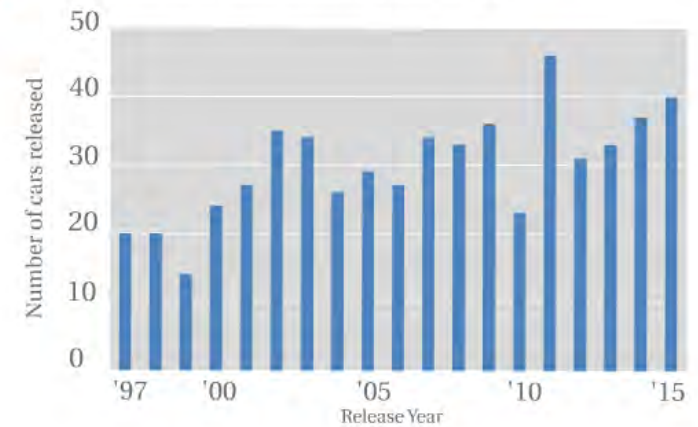
A public-private partnership of non-industry stakeholders from across Europe ensures independence.



**650+**  
ratings

## Market relevance

The number of cars tested varies per year as it depends on members' and manufacturers' sponsorship.



**8**  
labs

## Independent testing

Safety tests are carried out at specially accredited facilities located in six countries.



**12**  
members

# Collaborating for safety

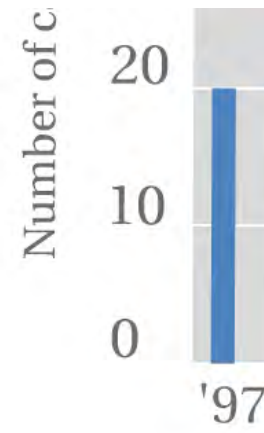
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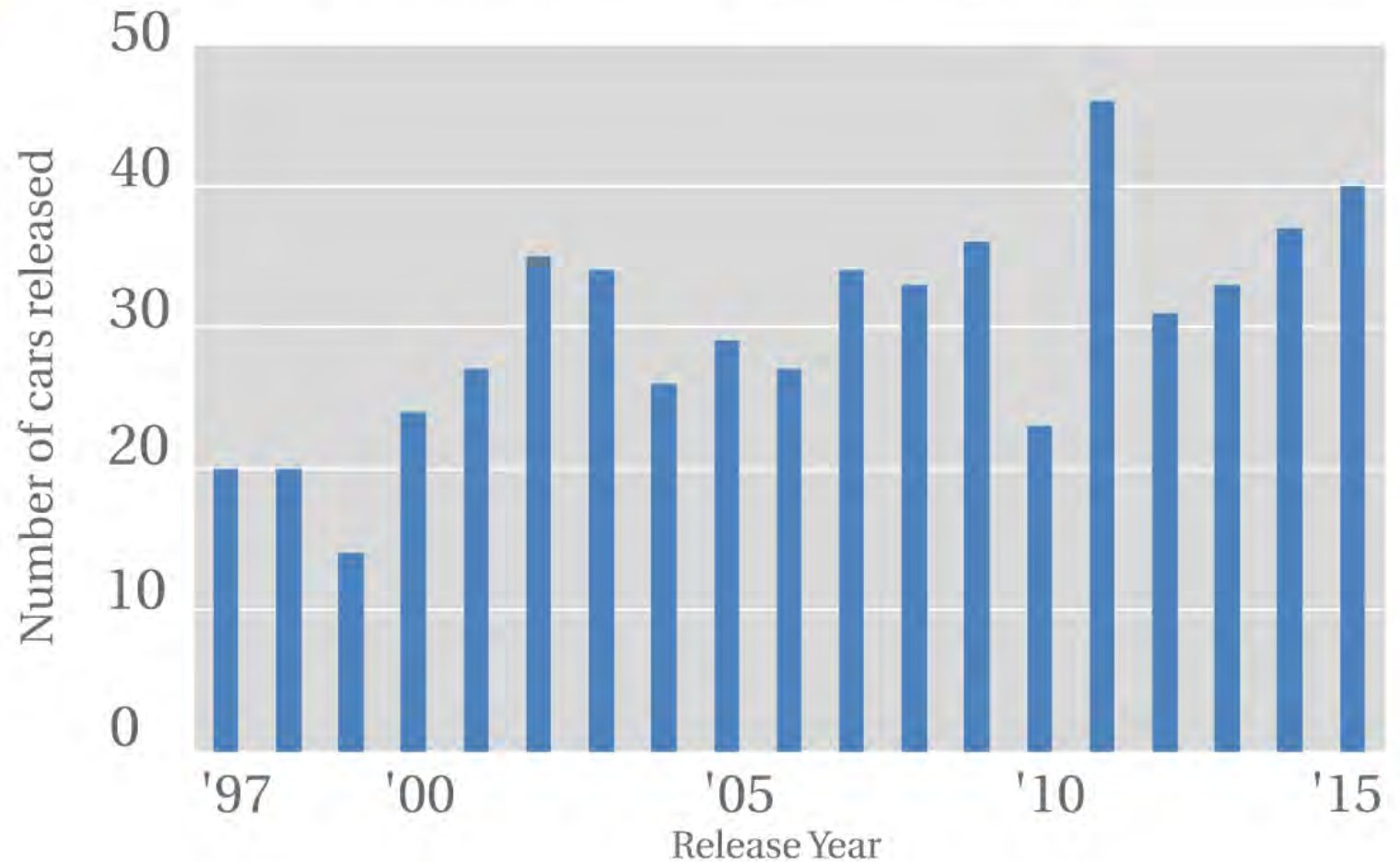
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sting

tries.



# Rating process

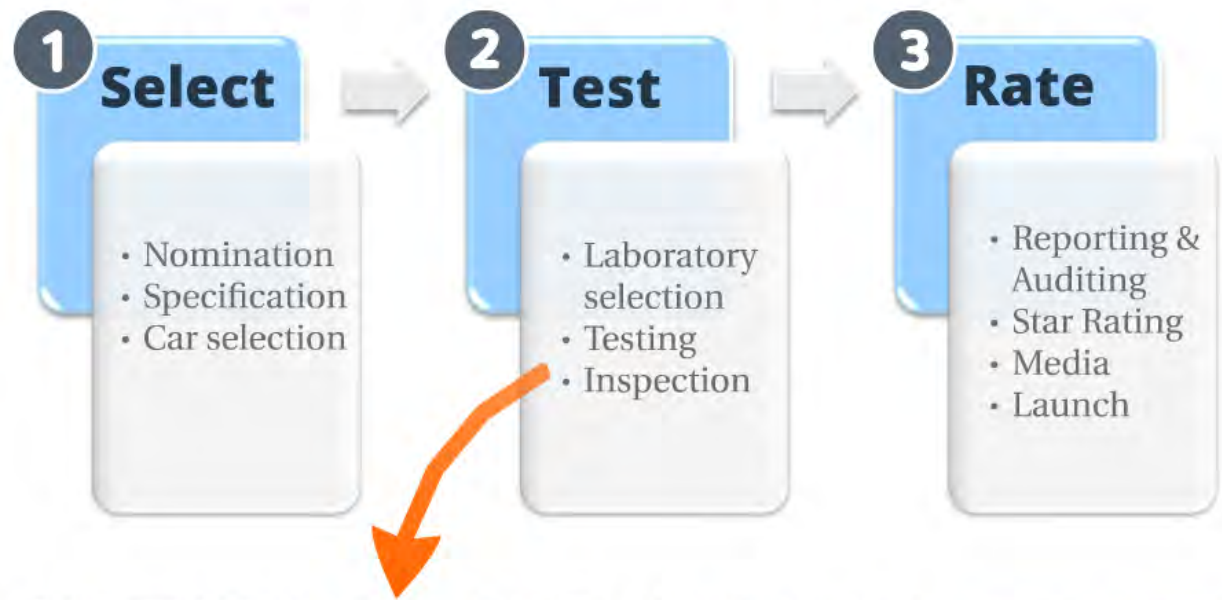
The process of testing, rating & publishing takes around 3 months

Test costs?

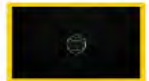


**€ 225,000\***

\*2015 baseline, based on average laboratory costs. Excluding consumables and rating charges.



Euro NCAP Test and Assessment protocols are public and regularly reviewed and updated. Technical Bulletins provide further guidance.



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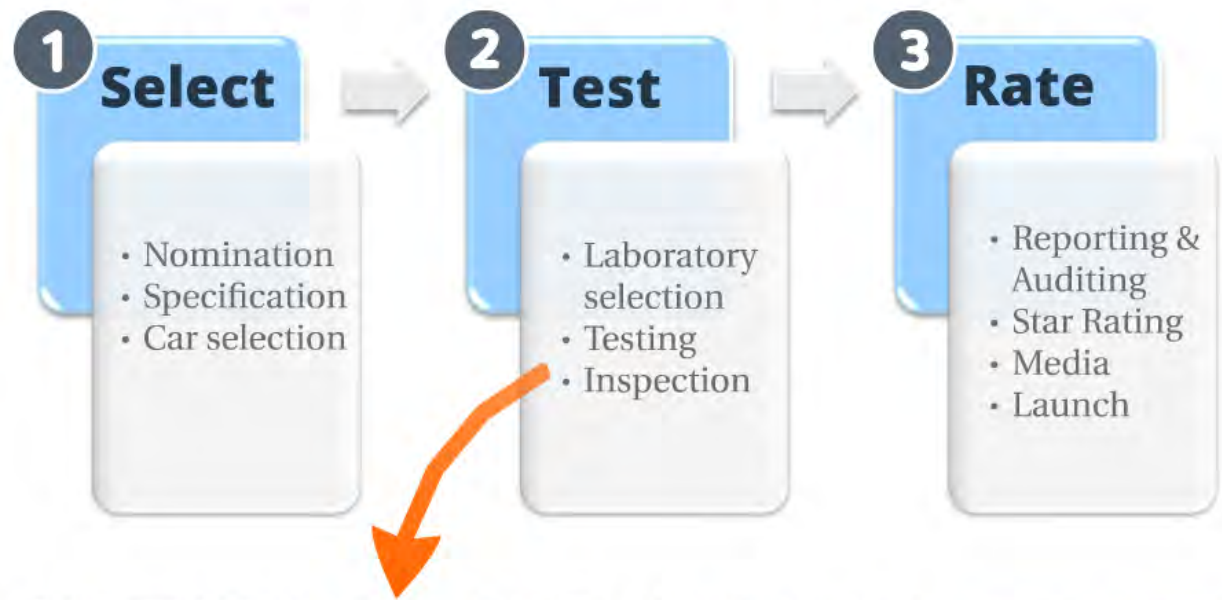
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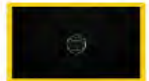


**€ 225,000\***

\*2015 baseline, based on average laboratory costs. Excluding consumables and rating charges.



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# Vehicle sales

**94%**

of new cars sold\* in  
EU28 hold an  
Euro NCAP safety  
rating

**3%**



**16%**



**75%**



*\*Passenger Car & SUV Sales , 2016 H1, 7.974.199 units.*

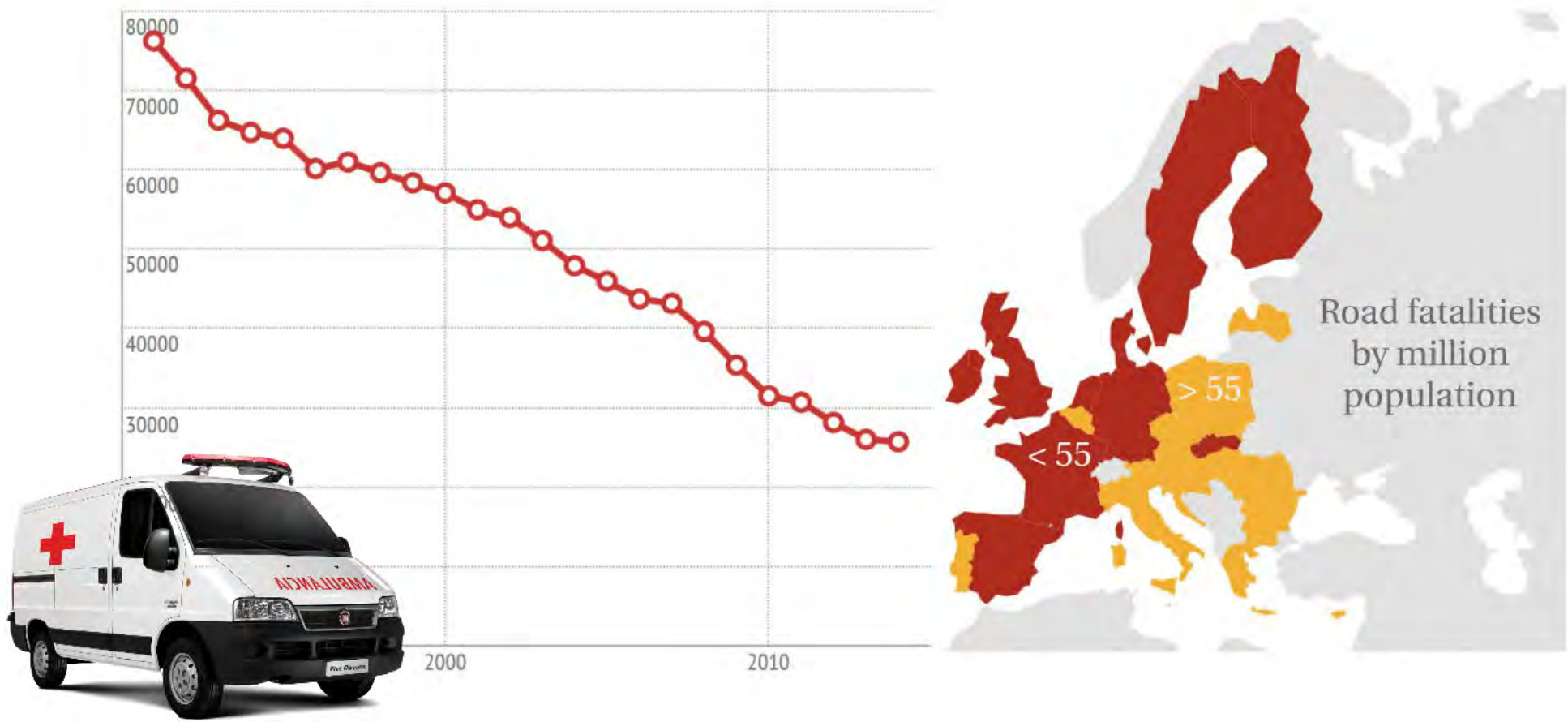
# Test campaigns

Extending the scope beyond M1-category vehicles, e.g. heavy quadricycles.



# Road safety evolution

Road fatalities in EU-28



Source : CARE (EU road accidents database) or national publications, European Commission / Directorate General Energy and Transport

# Better car safety

Improved structures and restraint systems delivered better protection of occupants in crashes.



Now complemented with Crash Avoidance & Driver Assist Systems ...

**Active Blind Spot** **Speed Assistance**  
**Pedestrian Detection**  
**Lane Keeping Aid** **Electronic Stability Control**  
**Autonomous Emergency Braking**  
**Seat Belt Reminder**



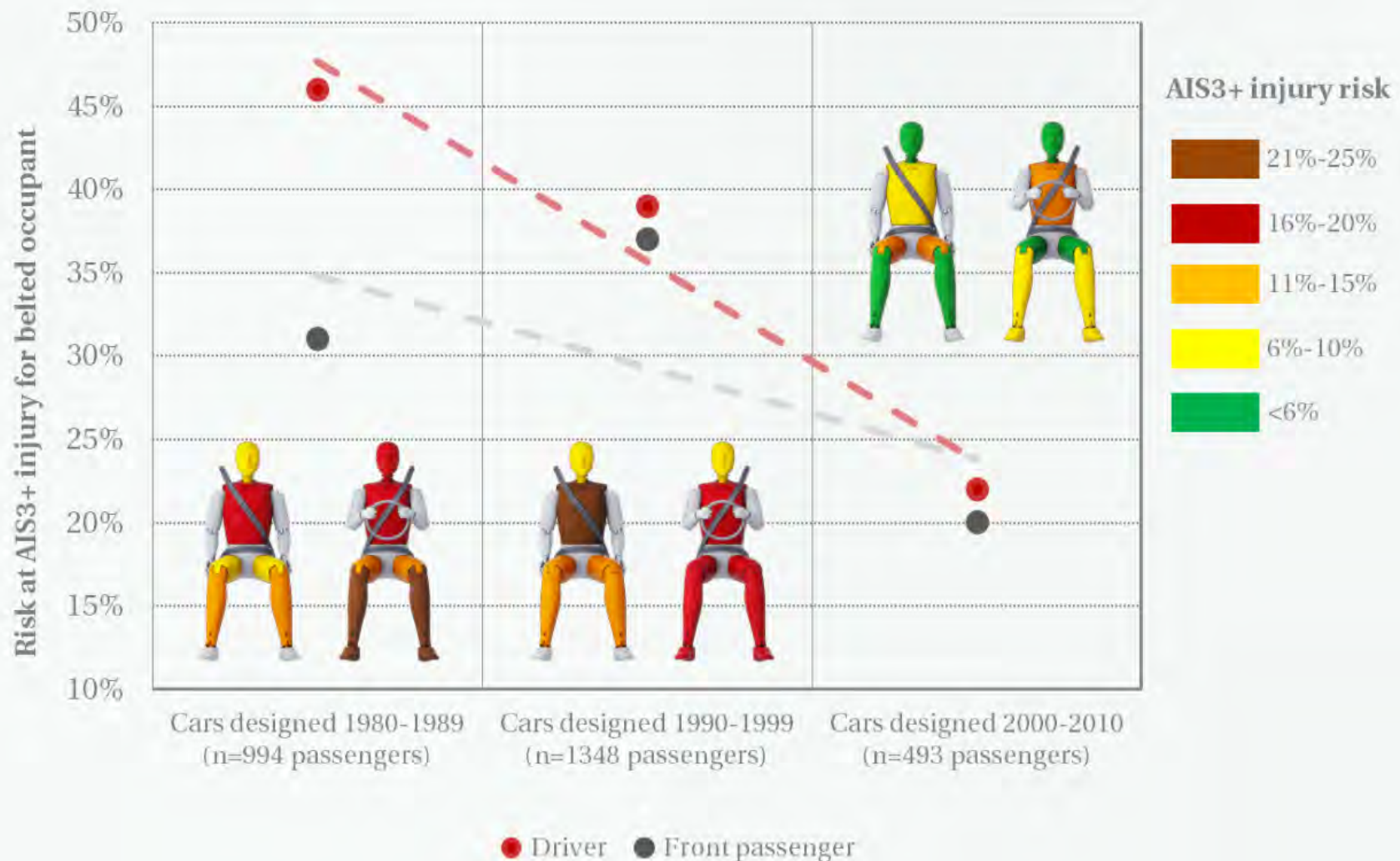
© Ford Motor Company

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**Autonomous Emergency Braking**  
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# Evolution of injury risk

Breakdown by body regions and designed model years (source: LAB - France).







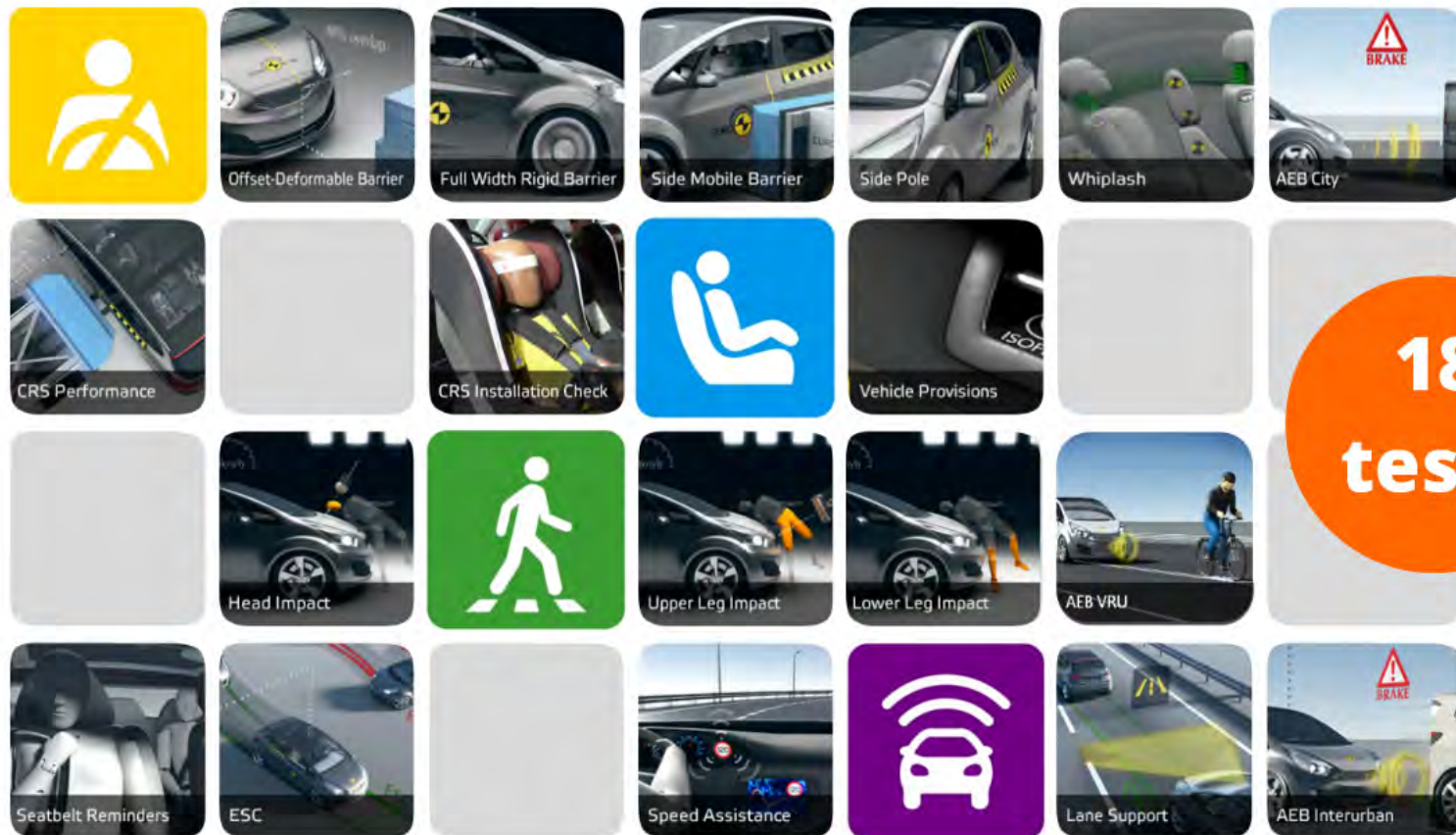
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# Overall safety rating

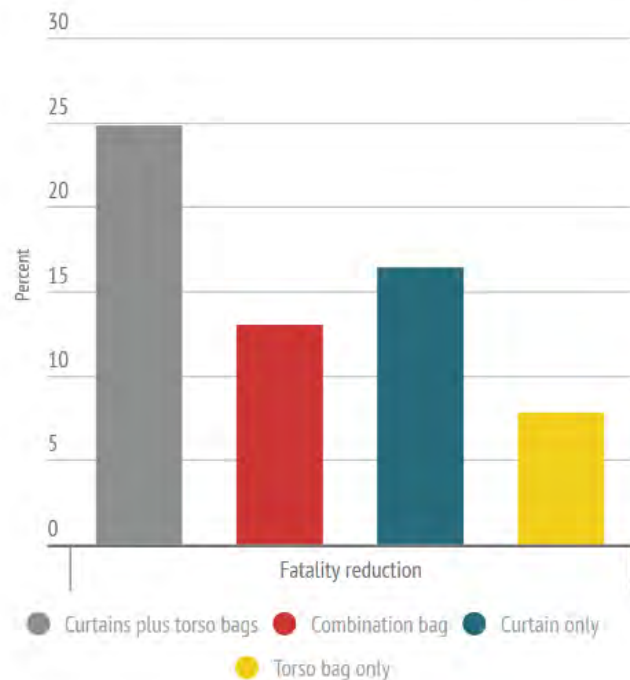
A single combined safety rating since 2009



# Head protection

Car makers have increased fitment of safety equipment such as head-protection curtain bags.

Fatality reduction by curtain and side airbags in near-side crashes (NHTSA, 2014)



“

*Share of superminis with standard side head protection systems went from 50% to 100% as a result of strict pole test requirements*

# Supporting belt usage

Seat belt usage went up thanks to an increasing number of cars with intelligent Seat Belt Reminder systems.

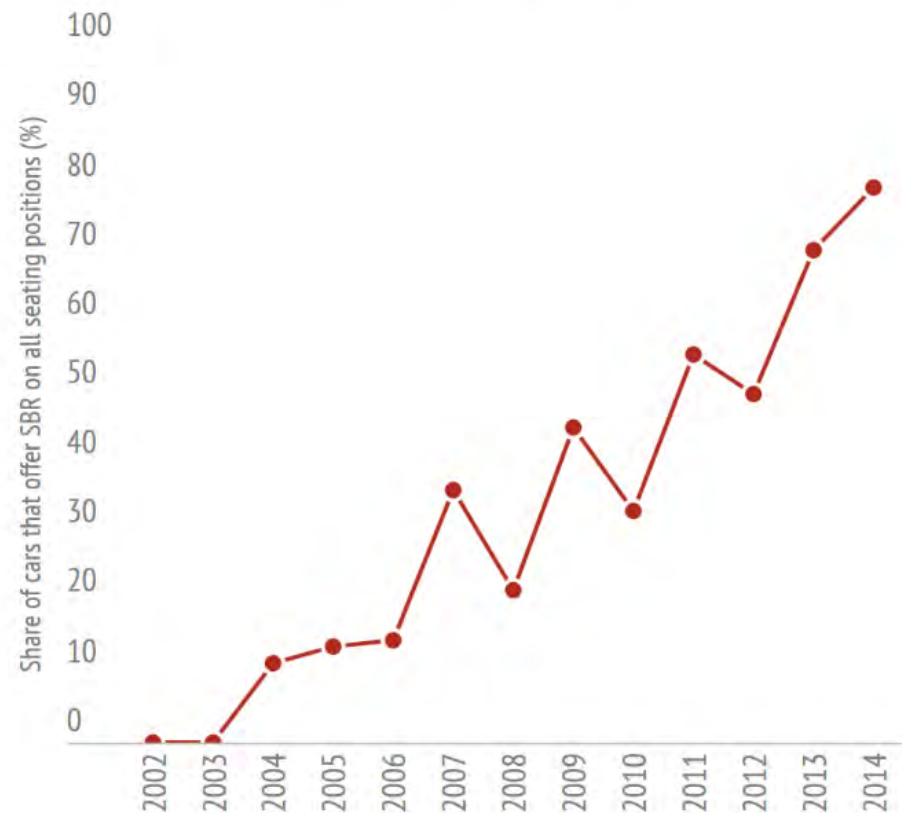


**✘**  
73%

Percentage of the occupants using a seat belt in seats without SBR.

**✔**  
93%

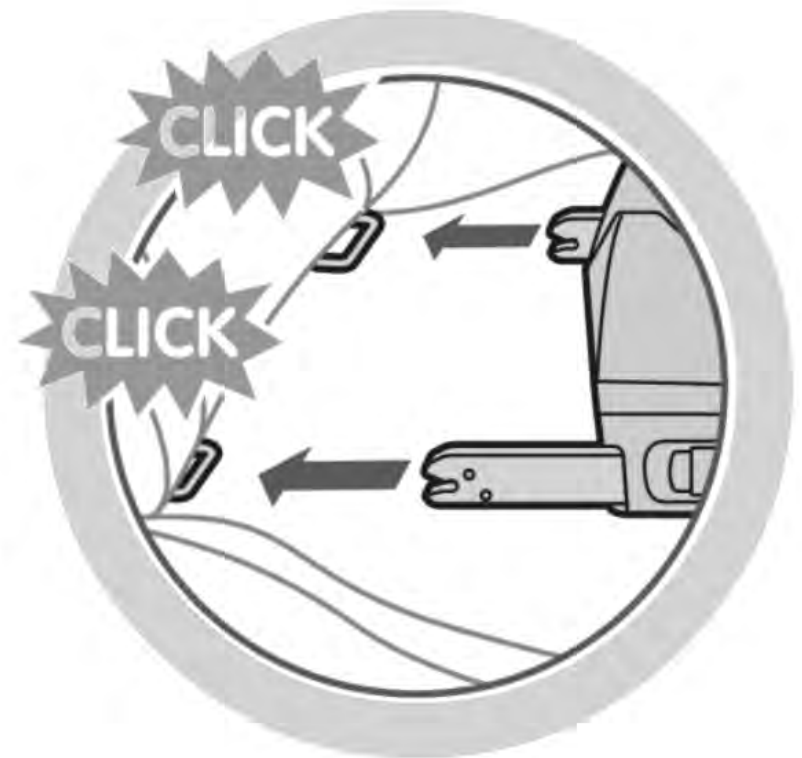
Percentage of the occupants using a seat belt in seats with Euro NCAP compliant SBR.



Source: Nonconformities in real-world fatal crashes--electronic stability control and seat belt reminders. A. Lie (2012)

# Keeping kids safe

Euro NCAP tests a car suitability for safe transport of children and encourages standard ISOFIX fixtures.



# Pedestrian protection

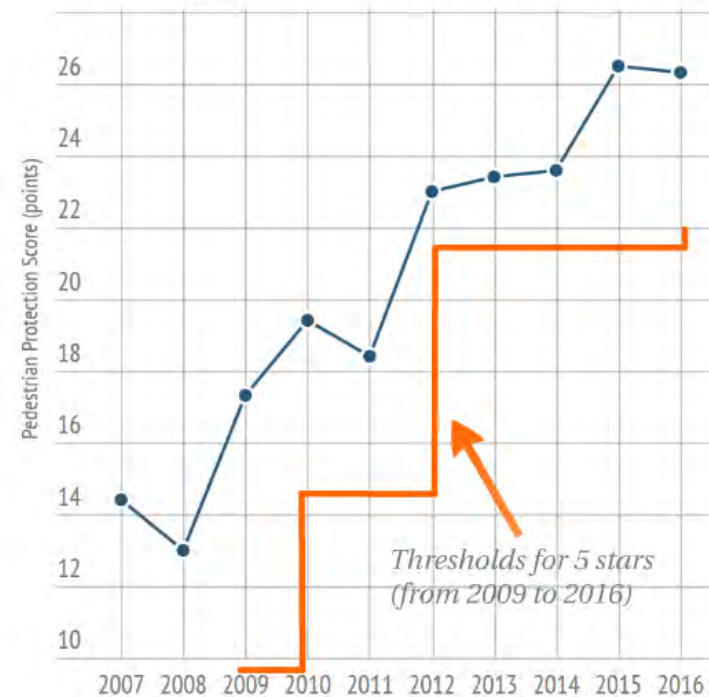
Sub-system testing meant that vehicle front-end structures became more forgiving in pedestrian collisions.



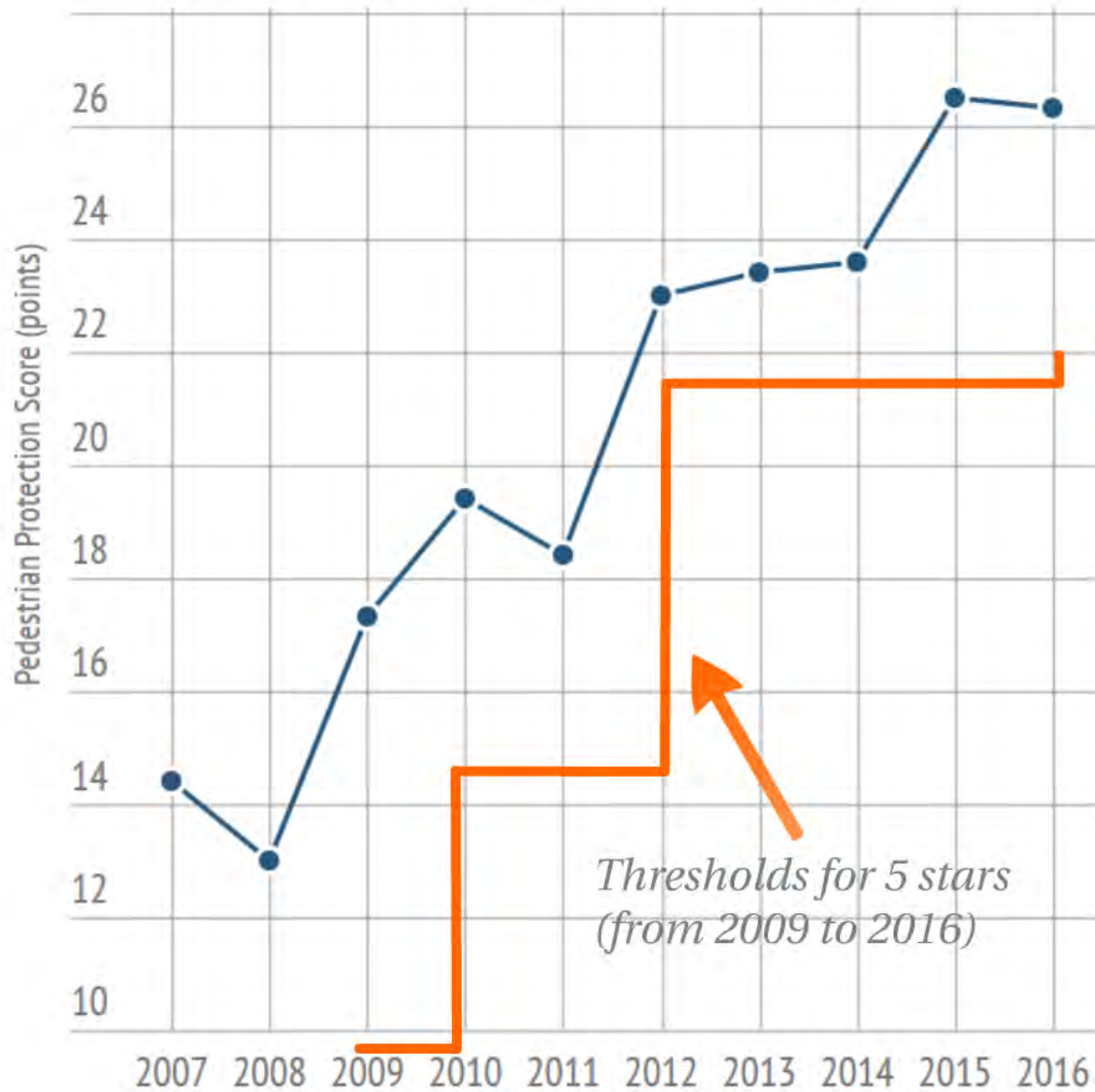
“

*As a rule of thumb, each point ... relates to a relative reduction in probability of 2.5% for fatalities, and 1% for serious injuries. - Claus Pastor*

Average total points score in subsystem tests from 2007 to 2016



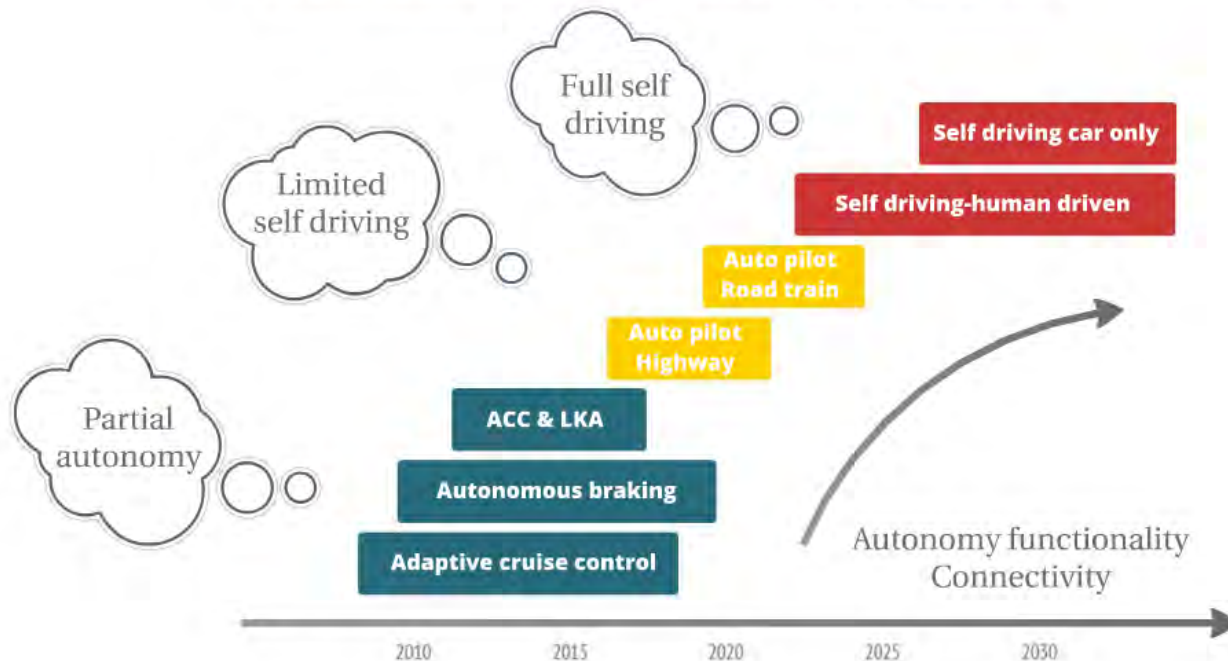
# Average total points score in subsystem tests from 2007 to 2016



# What cars must do next

Vehicle automation forms the backdrop for next development phase of the rating. Autonomous cars, driven by safety.

## Vehicle automation evolution



“

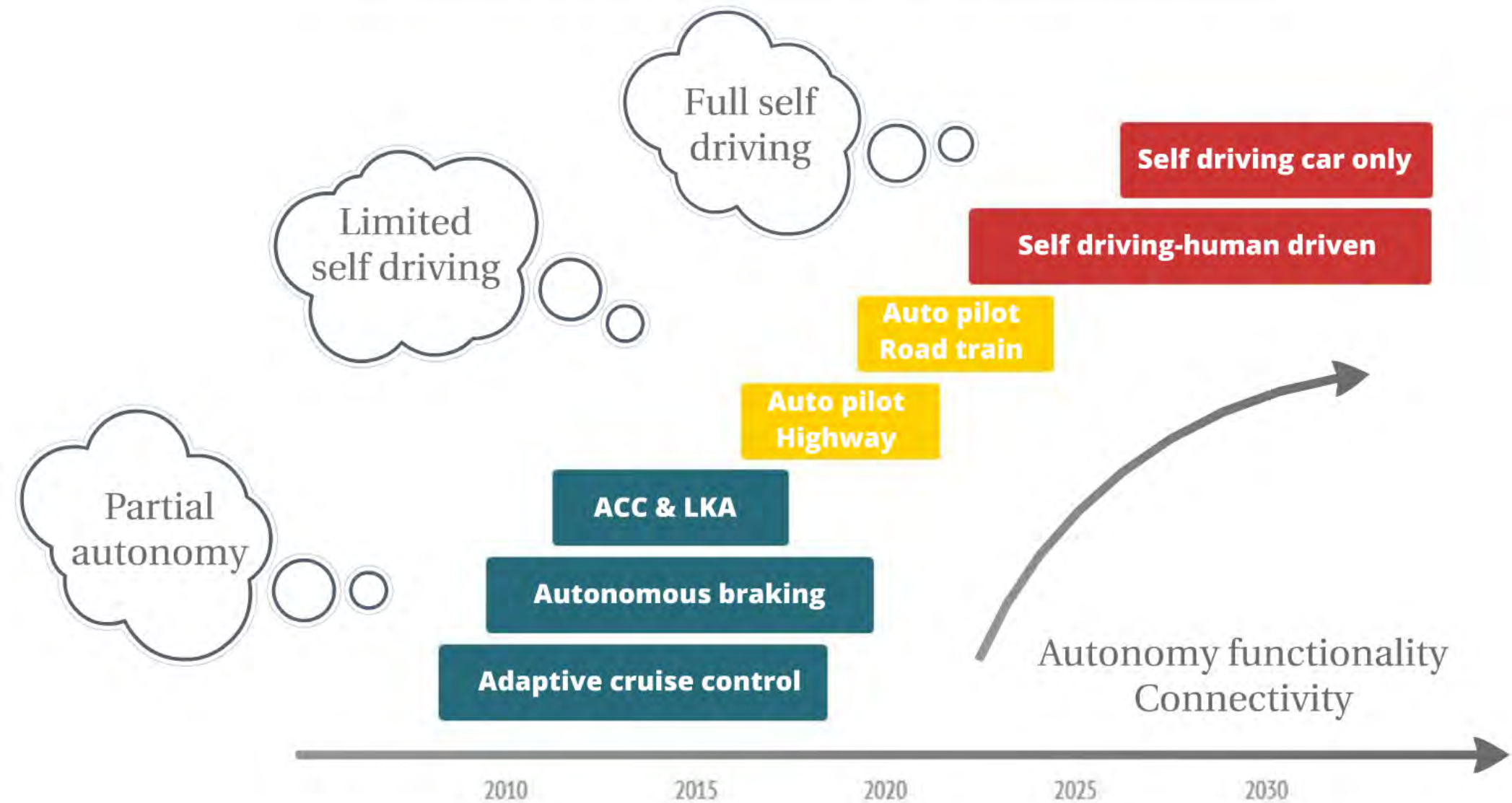
*The car is becoming a smartphone on wheels.*  
- Dieter Zetsche





iven by safety.

## Vehicle automation evolution

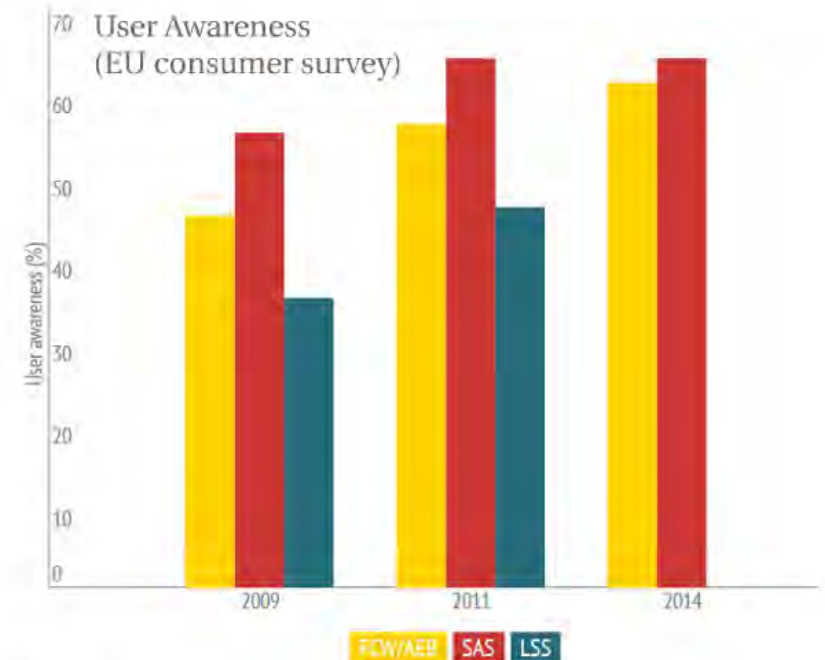


# Opportunities

The ADAS market is influenced by many factors: economical, social, legislative, technological, ...

## Growth Drivers

- Push for greater road safety.
- Innovation, need for new features.
- Consumers interest is growing.
- Prices are coming down.



Share of respondents who have either heard or used the system. Source: eSafety Challenge consumer studies 2009 and 2011 and iMobility consumer survey 2014 (no data on LSS).

# Challenges

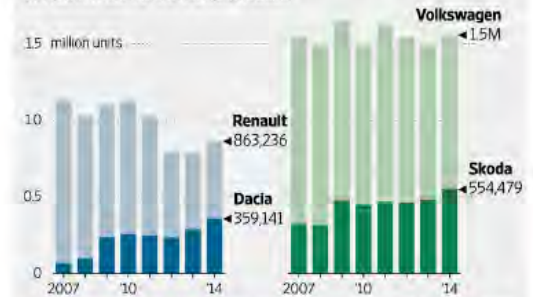
But a continuing strong advocacy effort is needed to counter the factors that slow down uptake in Europe.

## Market Restraints

- Consumer reaction to any system “failures”.
- Pushback on technology (no-frills).
- Pricing strategies, economic crisis.
- Lack of market incentives.

### European Car Buyers Trade Down

No-frills Dacia and Skoda vehicles are giving a lift to their parent companies' sales in the European Union.



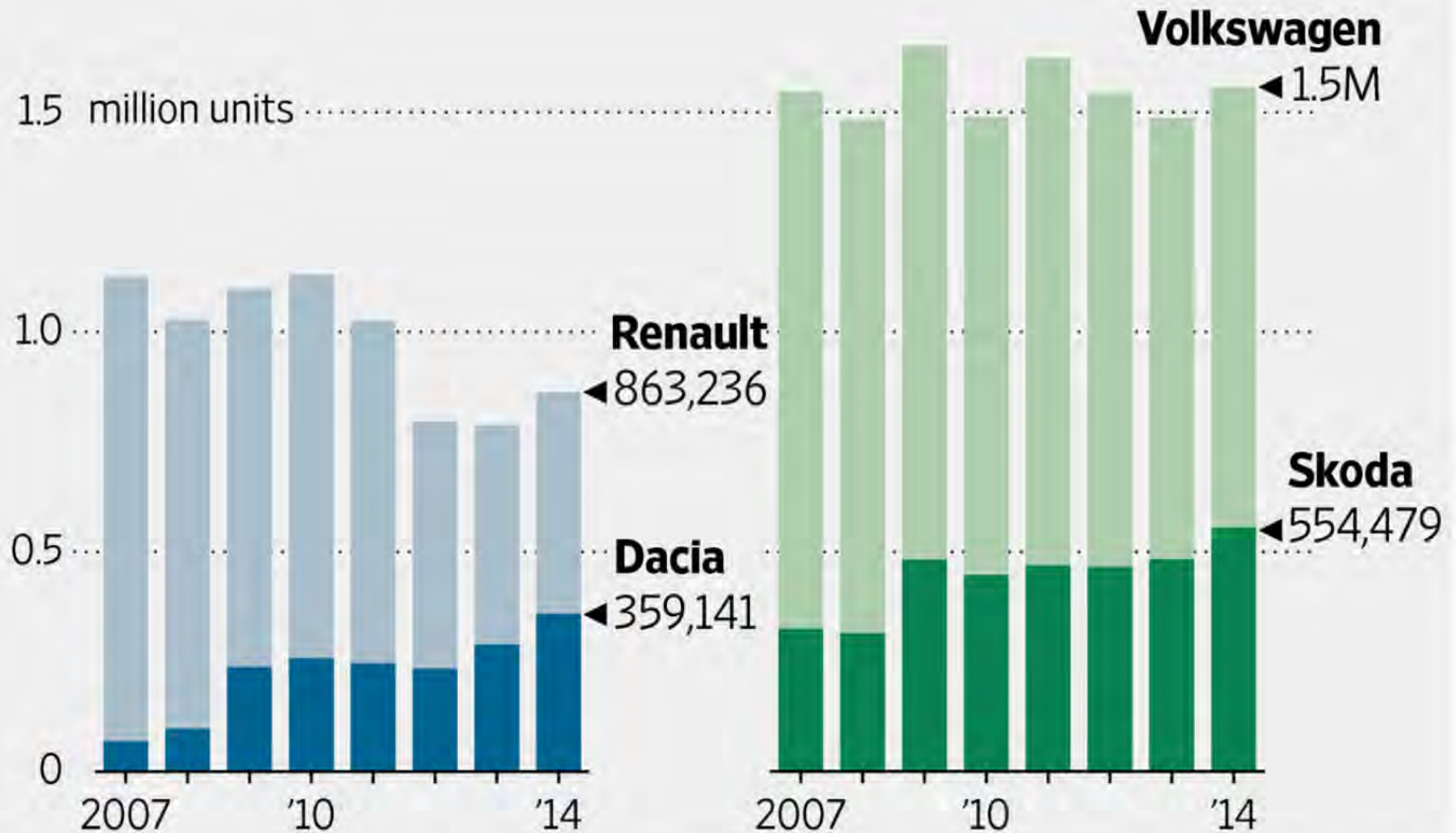
Source: European Automobile Manufacturers' Association

The Wall Street Journal



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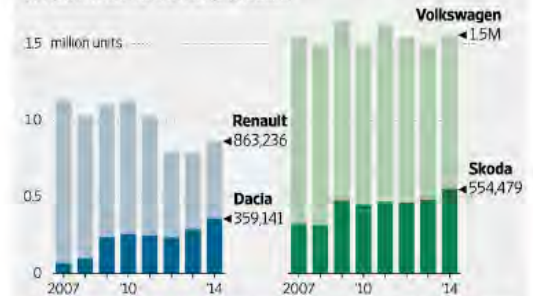
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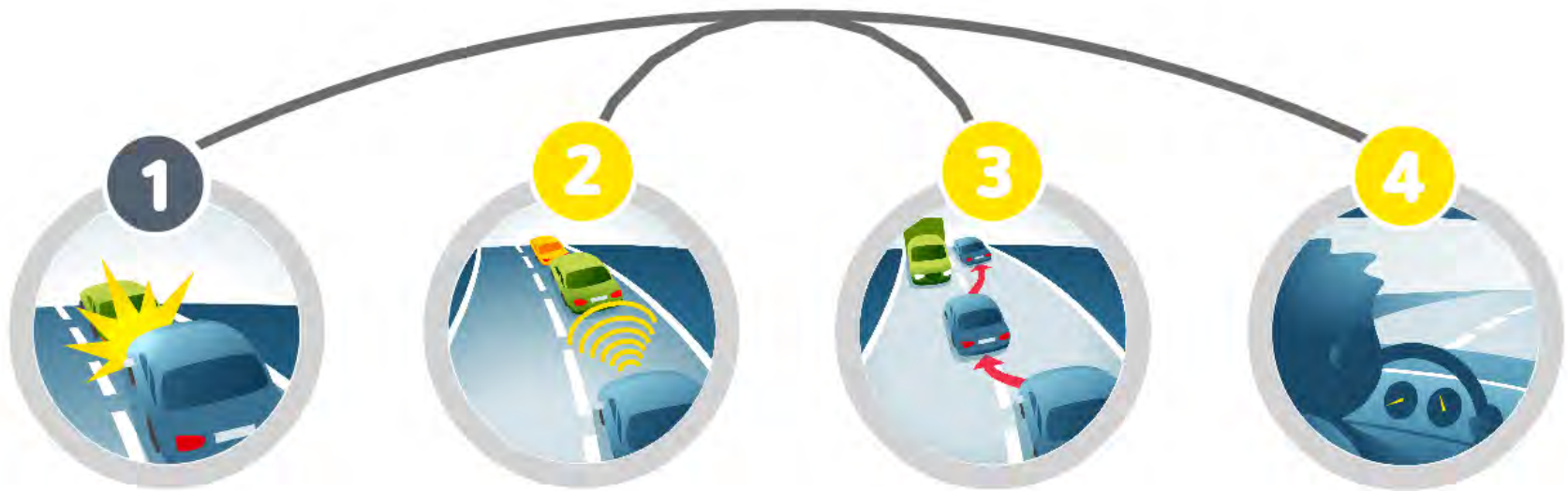


Source: European Automobile Manufacturers' Association

The Wall Street Journal



# Priorities in safety



Occupant protection in front and side crashes

*(crash protection)*

Autonomous braking for cars and vru

*(crash avoidance, information, warning & intervention)*

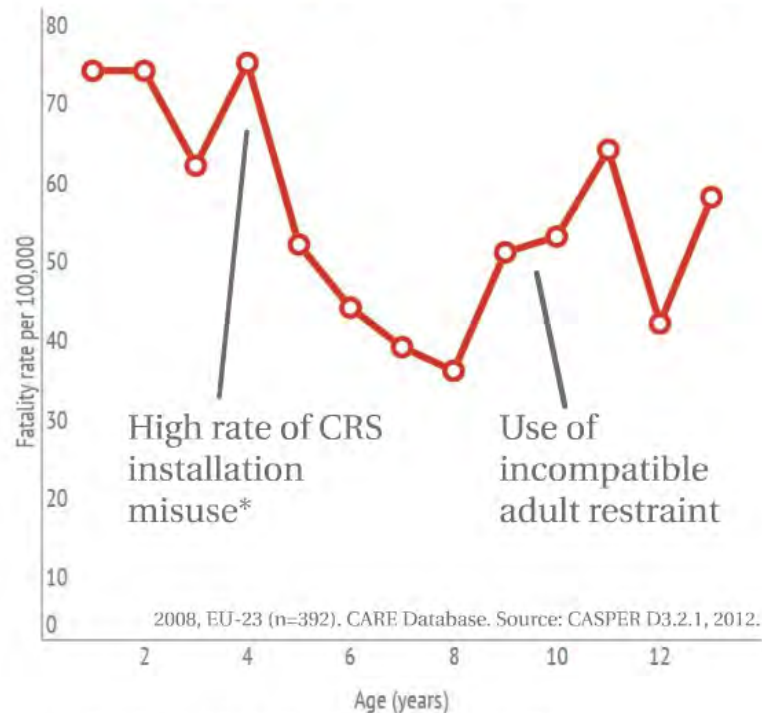
Lateral assist systems

Speed & impaired driving

# Children in cars

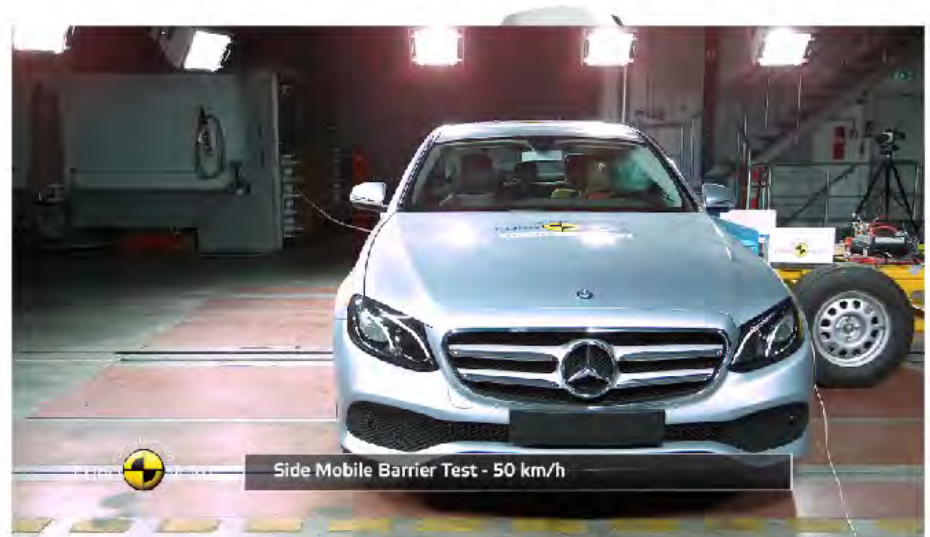
This year Euro NCAP updated its child occupant protection test, driving better restraints & other provisions in the rear ...

**Child car passenger fatality numbers by age**



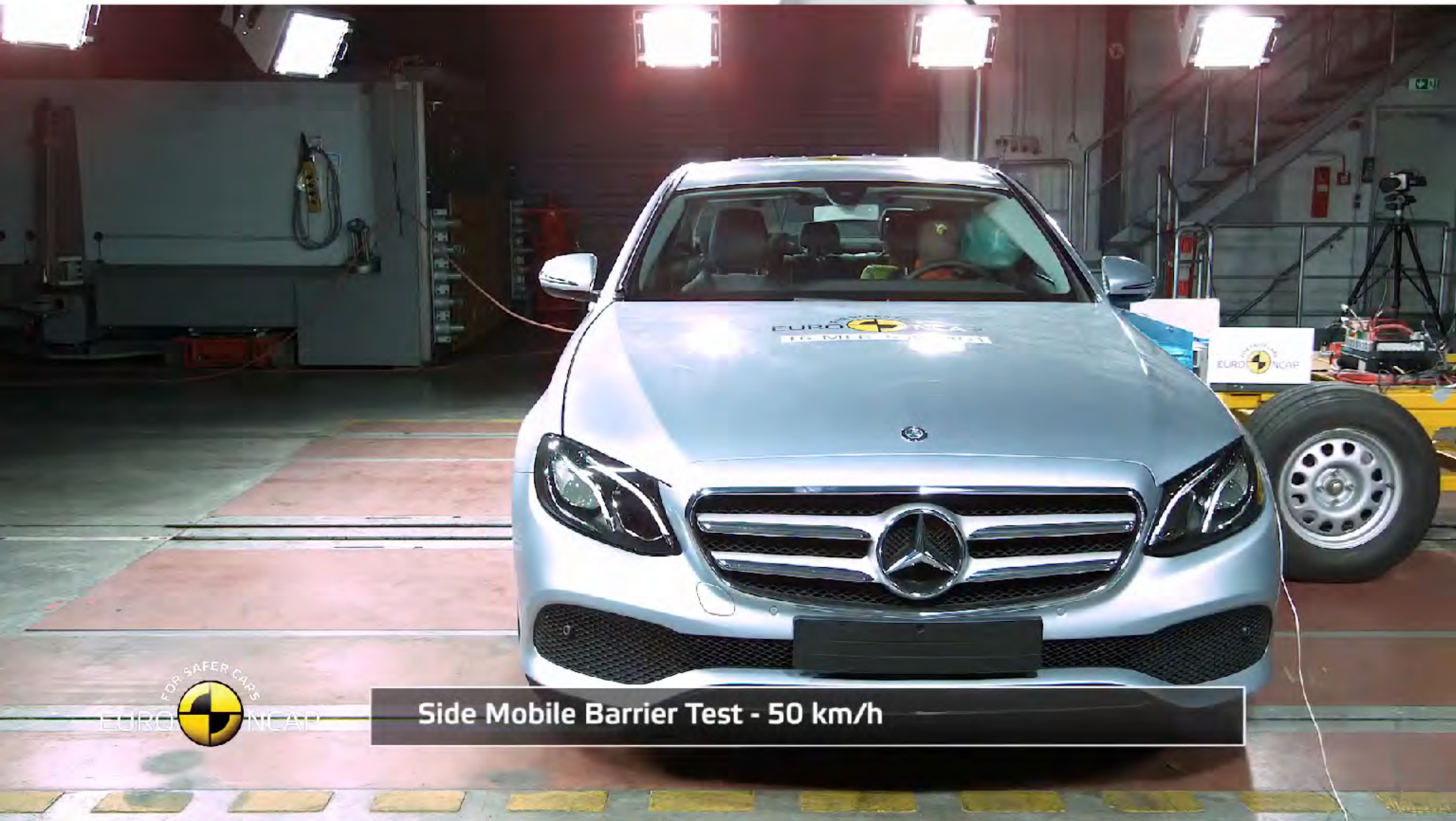
\*Addressed by CRS installation check (2013)

**Protection of older children in front and side crash**



Adoption of Q6 and Q10 dummies in front and side crash test

# Protection of older children in front and side crash



Side Mobile Barrier Test - 50 km/h

adoption of Q6 and Q10 dummies in front and side crash tests



# Far side crashes

In 2018, incentives will be added to reduce head injury risk for belted drivers and front passengers in far side crashes ...

Countermeasure	Mechanism	Expected benefit
Belt pretensioner	Reduce slack and tighten the belt.	1 person icon
Inboard side support	Restrain occupant from moving inboard.	3 person icons
Altered 3 point belt geometry	Restrain occupant from moving inboard.	2 person icons
Nearside head and thorax airbag	Provide cushioning between deformed struck side and occupant.	3 person icons

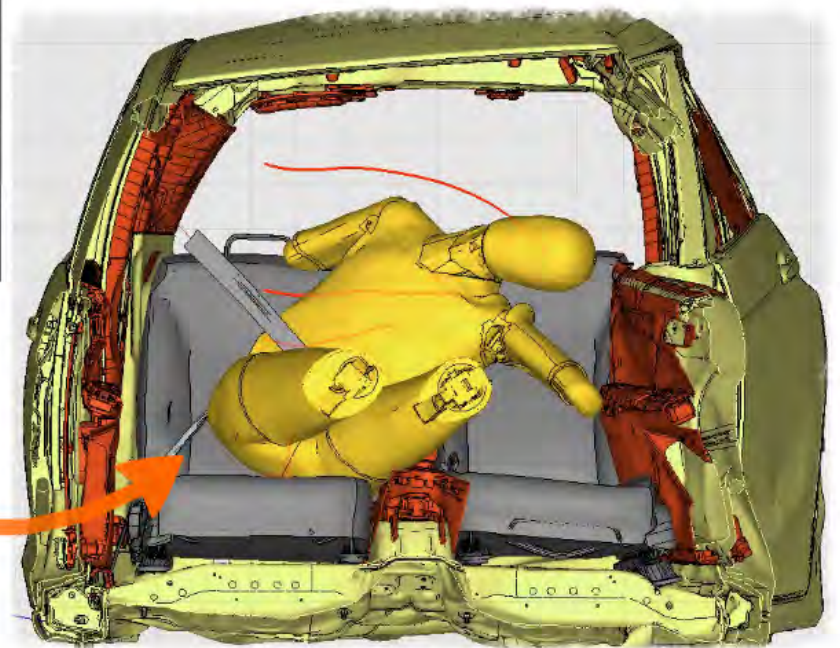
Source: Sander et al. (2010)



© General Motors

## Advanced Side Impact System to evaluate the effectiveness of:

- Front center airbag (FCAB).
- Curtain airbags with extended coverage and inflation time.
- Advanced belt systems, etc.



© ACEA

# Compatible structures

In 2020, the introduction of a mobile barrier test for moderate off-set crashes is planned to promote more compatible front-end designs.

## Mobile progressive deformable barrier test



Moving barrier: 1400 kg, PDB face; 50 km/h; 0 degrees and 50% overlap.  
Vehicle speed: 50 km/h.

© ADAC

## THOR-M mid-size male ATD



- Updated geometry
- Improved biofidelity
- New measurement channels
- in-dummy DAS

€ 800,000

# Mobile progressive deformable barrier test



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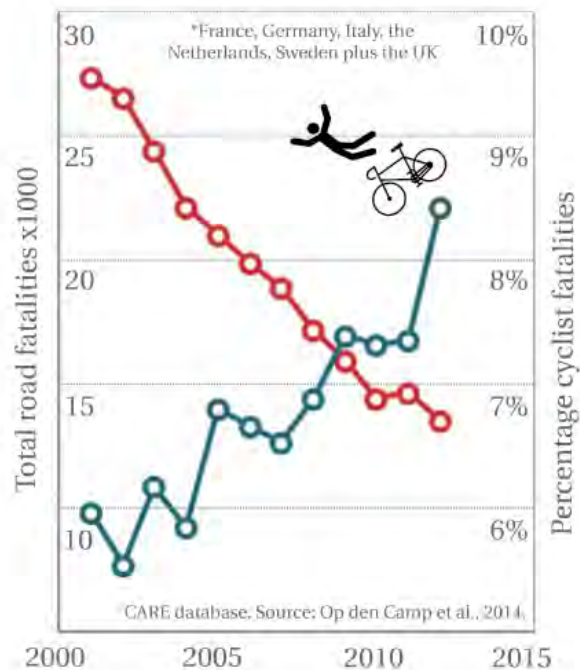
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# VRU Crashes

Almost half of all EU road deaths in urban areas involve a pedestrian or a cyclist. Causes include obscureness, high vehicle speed and unsafe road user behavior.

Trends of EU6\* total road fatalities and cyclist fatalities



“

*The risks to [vru's] are likely to increase rather than decrease with ever rising traffic volumes in our growing cities. - EU Commissioner for Transport Siim Kallas*

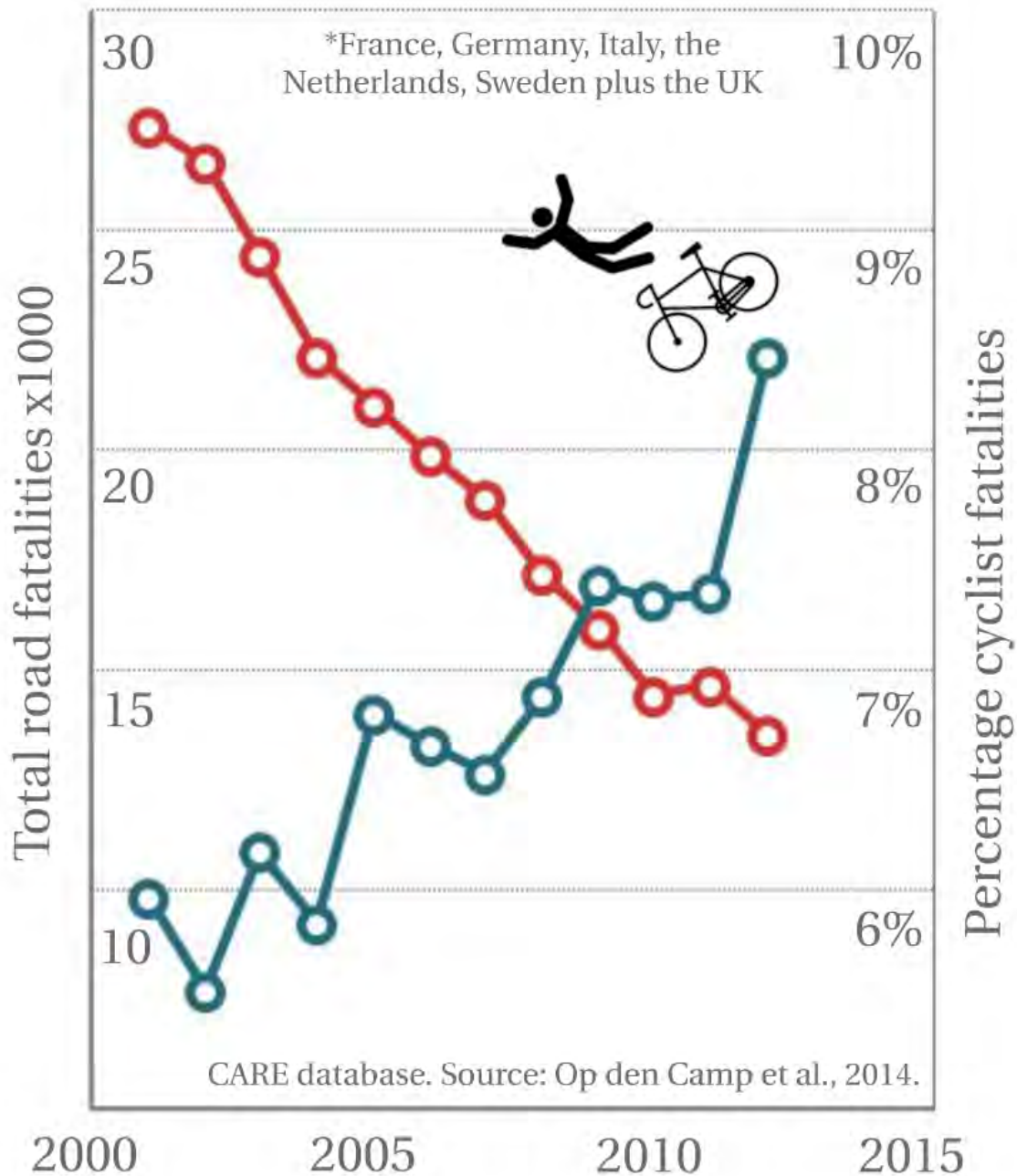


\* Euro NCAP adopted the articulated target for 2018 onwards.



© The Motorist

# Trends of EU6\* total road fatalities and cyclist fatalities



“

*The risks to [vru's] decrease with even cities. - EU Comm*

**2016 AEB Pedestrian - 3 test sc**

**EURO NCAP**

**AEB VRU Pedestr**

\* Euro NCAP adopted the articulated target for 2016



## 2016 AEB Pedestrian - 3 test scenarios\*



# AEB VRU Pedestrian

\* Euro NCAP adopted the articulated target for 2016 onwards.

© 4a-engineering





# 2018 AEB Cyclist

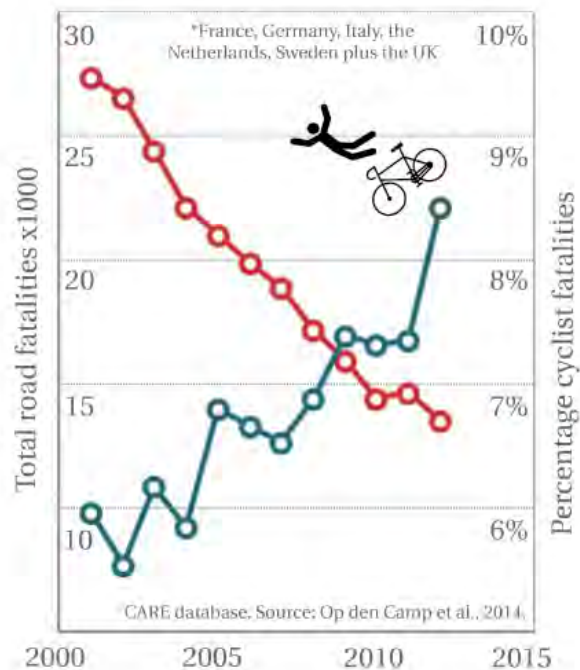


## AEB VRU **Cyclist**

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© The Motorist

# Stop the crash!

Updated AEB car-to-car tests will focus on improving robustness in typical rear-end crashes and expanding into junction and head-on crashes.

## Improve AEB robustness in rear-end crashes

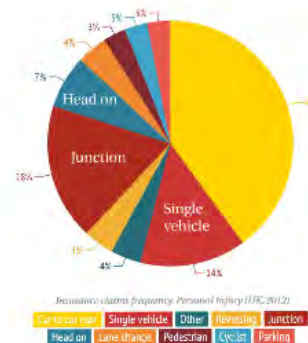
Current tests at low and high speed ...



Future tests?



## Addressing new priority crashes with AEB



# Improve AEB robustness in rear-end crashes

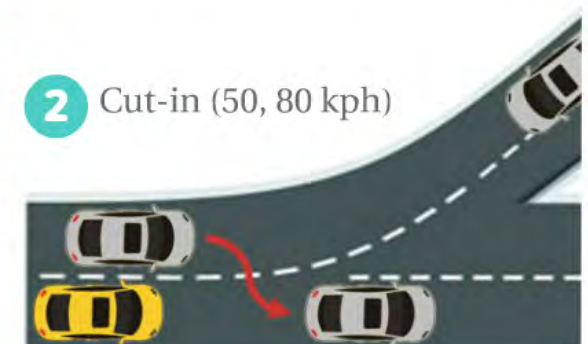
Current tests at low and high speed ...



Future tests?



1 Full to partial overlap & angled approaches (30-80 kph)



2 Cut-in (50, 80 kph)

# Current tests at low and high speed ...

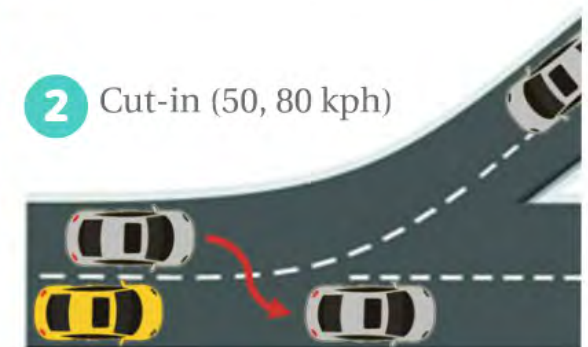


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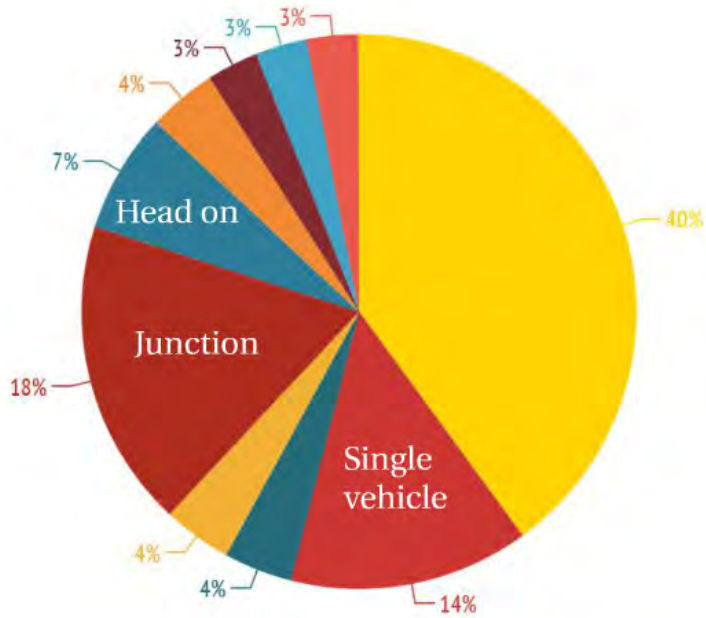
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Future tests?



# Addressing new priority crashes with AEB



Insurance claims frequency, Personal Injury (UK, 2012)



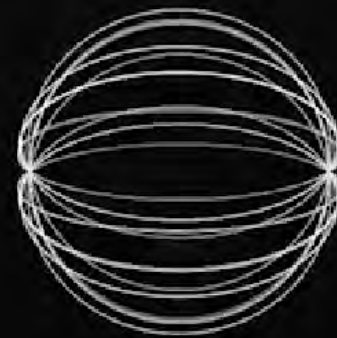
**1** Partial overlap head-on (40, 64 kph)



**2** Junction, turning into traffic ahead (10, 50 kph)



**3** Junction, crossing ahead (10, 50 kph)



3D soft guided target for avoidance testing



# Stop the crash!

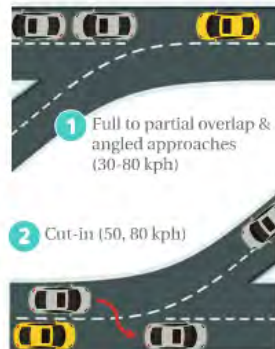
Updated AEB car-to-car tests will focus on improving robustness in typical rear-end crashes and expanding into junction and head-on crashes.

## Improve AEB robustness in rear-end crashes

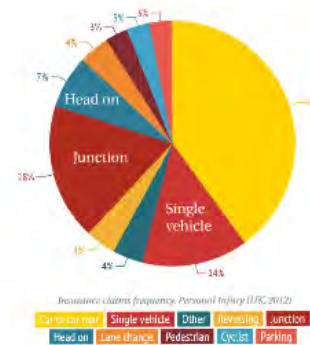
Current tests at low and high speed ...



Future tests?



## Addressing new priority crashes with AEB



# Single vehicle crashes

Lateral lane support is a critical element in realizing self-driving capabilities. Better systems are needed to avoid unintended road departures.

## Lateral support systems and what they do

### Detection

- Marked center line, shoulder; solid and dashed, white, yellow lines, etc.
- Road edge, obstacles



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### Warning/intervention

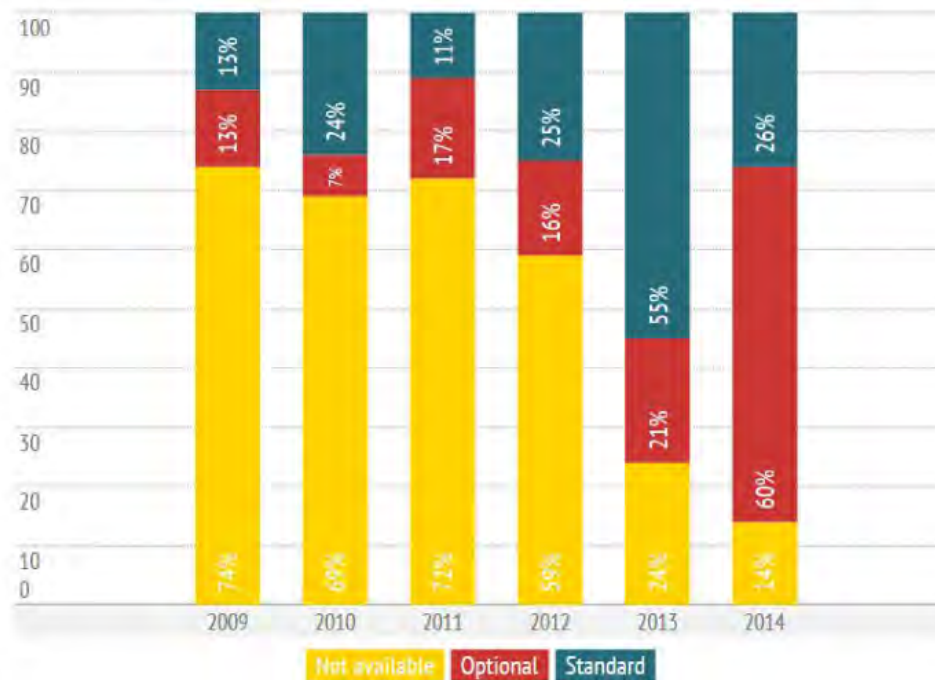
- Warning and/or corrective steering torque
- ESC activation in critical situations



# Safe Speed

Speed assistance: not the most popular, but one of the most cost-efficient ways to improve road safety.

SLD/SAS installation in Euro NCAP rated vehicles



Items included in the 2018 protocol revision:

- Frequent & free updates of digital map data.
- Inclusion of sub-signs (containing conditional restrictions).
- Speed limit information always available.
- Improve the absolute accuracy of the speed indicated by the speedometer.



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# IWI strategies

The role of the driver takes center stage in the evolving world of automation. The IWI strategy will require higher levels of standardization within industry.



# Summary

Planned updates to the safety rating until 2020 ...



*New test tools required ....*



# Future of safety

Auto technology and telematics solutions are rapidly evolving — the 4 biggest challenges we face ...



Rating of automated driving functions



Incorporating telematics & cloud (OTA) system updates



Changing occupant interior environment



Safety assessment based on real traffic scenarios



Rating of automated driving functions



Incorporating telematics & cloud (OTA) system updates



Changing occupant interior environment





g telematics &  
system updates



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# How Consumer Ratings Drive Vehicle Safety Improvements

Michiel van Ratingen - Euro NCAP

