SAFETY COMPANION 2017

carhs.
Empowering Engineers

SEMINARS	CONFERENCES	KNOWLEDGE
Active & Passive Safety Dummy & Crash Test Engineering & Simulation	News Knowledge Exchange Networking for Experts	Tables & Graphs Summarizing all Important Rules & Regulations in Vehicle Safety

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Seminar Guide

Here you find the courses you need to get your job done!

Haven't found what you need? Get in touch with us!

☎ +49-6023-964060

Legend

- ▶ Seminar/**Event** that focusses on this topic
- ▷ Seminar/**Event** that deals with this topic (among others)

Dummies + Crash Test

Frontal Impact

Side Impact

Rear Impact

Pedestrian Protection

Sem
Gui

Car Bodies

Interiors

Restraint Systems

Regulations and Requirements

Accident Avoidance

Materials

The Importance of Continuous Learning

SAFETY COMPANION 2017

Safety**Wissen** on more than 60 pages

more than 140 seminars & events

The change in the automotive industry is ubiquitous. New technologies profoundly alter the business and established corporations are suddenly facing the competition of start-ups. Development processes that have been meticulously optimized need further acceleration and totally new development steps are suddenly required.

The possibilities, but also the necessities that result from new business models and a continuously increasing degree of digitalization, are enormous.

These big challenges are mastered best by those companies that systematically prepare their employees for the new developments and those that invest into the capabilities of their personnel.

We are not born with capabilities; we are trained for capabilities. And this exactly enables engineers to constantly adapt to changing requirements and to actively create the future.

With the SafetyCompanion we have compiled an attractive program of seminars and events, that covers the whole breadth of automotive safety: from passive safety to accident avoidance and safety for automated driving.

In addition to the offerings in the SafetyCompanion, we also cater for your individual needs for customized trainings, e.g. training on your premises. Use our experience and the expertise of our trainers to achieve your goals.

Our knowledge services have again been expanded significantly. Five new knowledge pages have been added to the SafetyCompanion; more than 40 pages have been updated. Our web portal www.safetywissen.com continues to be popular with engineers worldwide. Daily news from the world of automotive safety and thousands of global requirements documents make it a valuable resource for automotive engineers.

Now is the best time for your company and your associates to embrace the tremendous changes in the automobile industry for your benefit. We are happy to support you.

For the whole team of carhs.training

Rainer Hoffmann
President & CEO

Ralf Reuter
Executive Vice President

In-house Seminars

Seminars at your site - efficient, flexible and customized

Are you looking for an individual and customized training for your employees?

Most of the seminars from our training program can also be booked as in-house seminars in English language. Whether on your company site or at another venue of your choice, the scale of our in-house seminars is tailored to your needs.

Your advantages

- You are in full control of cost. We offer attractive fixed prices for our in-house seminars, depending on the number of participants and the related service.
- Even for a small number of participants you can save a lot of money compared to the individual booking of seminars. Additionally, there are no costs for travel and time of your employees.
- We respect your target dates as far as possible – also upon short notice in „urgent cases“.
- You benefit from our professional organization and the top-quality seminar manuals.
- Our lecturers answer your individual questions.
- Even if you are interested in very specific questions – we are looking for a qualified lecturer and develop the seminar.

Many of our customers have integrated our in-house seminars into their company's training program.
Take advantage of this offer, too! We will be pleased to prepare you an individual offer.

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References

ACTS, Adam Opel, Audi, AZOS, Bentley Motors, Bertrandt, BMW, Bosch, Brose, CATARC, Continental, CSI, Daimler, Dalphimetal, Delphi, Dura Automotive, EDAG, Faurecia, Ford, Global NCAP, Grammer, HAITEC, Honda, IAV, Idiada, IEE, JCI, IVM, Lear, Magna, Mahindra & Mahindra, MBtech, Messring, Open Air Systems, PATAC, P+Z, SAIC, SMP, SMSC, Seat, Siemens, TAKATA, TASS, Tecosim, TRW, TTTech, VIF, Volkswagen.

Attractive Prices

With reference to our regular seminar fees we offer attractive discounts on our in-house seminars:

1 Day Seminar	
Discount	for the
30%	5th - 8th Participant
60%	9th - 12th Participant
70%	13th - 16th Participant
75%	17th - 20th Participant
80%	from the 21st Participant

2 Day Seminar	
Discount	for the
50%	5th - 8th Participant
70%	9th - 12th Participant
75%	13th - 16th Participant
80%	17th - 20th Participant
85%	from the 21st Participant

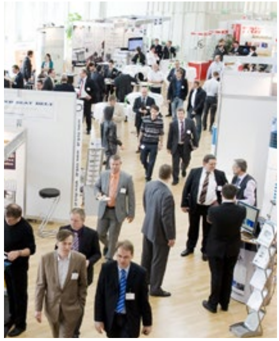
SAFETYWEEK
THE FUTURE OF AUTOMOTIVE SAFETY

Supporting automotive development engineers to further improve automotive safety, that is the essence of SafetyWeek.

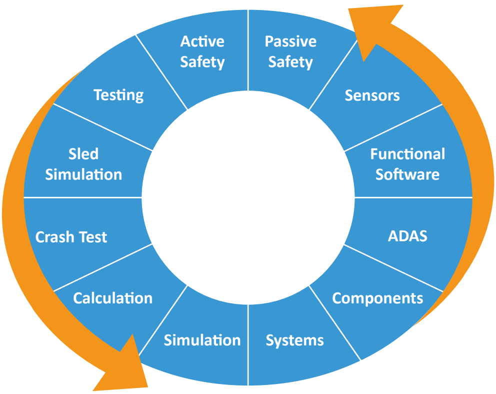
In a unique combination of knowledge congress, events and exhibition, SafetyWeek offers participants and visitors the opportunity, to bring their expertise up-to-date and to learn about the latest developments and technologies in product development and product verification.

In 2017 SafetyWeek will feature numerous highlights:

- The Knowledge Congress **SafetyUpDate *+active*** with the most current updates on requirements and solutions in active and passive safety. And again in 2017: presentations of the safety strategies and equipment of recently launched automobiles by OEMs ➲ page 14
- The **SafetyTesting *+active*** with the innovations from the Leaders in Testing and Simulation of components and systems in active and passive safety.
- The **Cooperation Forum Driver Assistance Systems** with a view into the future of mobility, organized by Bayern Innovativ
- The accompanying exhibition **SafetyExpo**, the meeting point for suppliers and decision makers in automotive safety.



SafetyWeek: Overview Topics and Products



Who should attend?

SafetyWeek is the meeting point for everyone involved in vehicle safety. This includes developers as well as test and simulation engineers from OEMs and suppliers, manufacturers of test systems, representatives of governments and consumer protection organizations and researchers from universities and research institutes.

Facts

DATE	16.- 18. May 2017
HOMEPAGE	www.carhs.de/safetyweek
VENUE	Stadthalle Aschaffenburg, Schloßplatz 1, 63736 Aschaffenburg
LANGUAGE	German with simultaneous translation into English
PRICE	from 420 EUR (single event)

SAFETYUPDATE +active

The concept is familiar: To keep software up-to-date you regularly make an update. The same is true for automotive safety engineering: To keep yourself up-to-date you have to attend the SafetyUpDate on a regular basis. Here you get a comprehensive overview of all relevant news in automotive safety.

Active + Passive Safety = SafetyUpDate *+active*

The SafetyUpDate reflects the close integration of active and passive safety and combines both topics in one event. General topics such as the NCAP consumer tests are dealt with in plenary presentations, whereas specific topics such as testing are presented in parallel session on active respectively passive safety.

Conference topics include:

- Regulations for active and passive safety
- NCAP consumer protection tests
- Development tools: Test & Simulation
- Development strategies & solutions
- Biomechanics & accident research

From Experts for Experts

The speakers are leading experts from government agencies, consumer protection organizations, industry and universities. We consider it important that the UpDate presentations are product-neutral and practical.

Meeting Point: Expert Dialog

In addition to the presentations the SafetyUpDate encourages the communication among experts. After the presentations the speakers are available for discussions at the Meeting-Point.

Who should attend?

The SafetyUpDate is aimed at automotive developers who are interested in active or passive vehicle safety and want to bring their knowledge up-to-date. In addition to the knowledge update, SafetyUpDate offers excellent opportunities to build and maintain contacts in the safety community.

Facts

DATE	16.-17. May 2017	26.-27. September 2017
HOMEPAGE	www.carhs.de/asu	www.carhs.de/gsu
VENUE	Stadthalle Aschaffenburg	Technische Universität Graz
LANGUAGE	German with translation into English	German with translation into English
PRICE	1.450,- EUR till 18.04.2017, thereafter 1.690,- EUR	1.450,- EUR till 29.08.2017, thereafter 1.690,- EUR

Introduction to Passive Safety of Vehicles

Course Description

Ever increasing requirements regarding vehicle safety have led to rapid developments, with major innovations in the field of Active and Passive Safety. Especially legal requirements in the USA (FMVSS 208, 214), the consumer information tests U.S. NCAP, Euro NCAP and IIHS, as well as pedestrian protection should be mentioned here. So far an end of this development is not in sight.

The seminar provides an introduction to Passive Safety of Vehicles. Passive Safety is about initiatives and legal provisions for the limitation of injuries following an accident. All important topics are covered in the seminar, from accident statistics and injury-biomechanics, which are decisive parts of accident research, to the crash-rules and regulations that are derived from the latter, and also to consumer information-tests with protection criteria and test procedures, and eventually to crash tests, where the compliance with the compulsory limits is tested and proven in test procedures. Specific attention is given to dummies, with which the potential loads on a person in an accident can be measured. Finally the basic principles of occupant protection are explained, and the components of occupant protection systems, respectively restraint-systems in motor vehicles such as airbags, belt-system, steering wheel, seat, interior, stiff passenger compartment and others, as well as their increasingly complex interaction, also in terms of new systems, will be discussed.

Course Objectives

It is the primary objective of this seminar to communicate an understanding for the entire field of Passive Safety with all its facets and correlations, but also for its limits and trends. In the seminar you are going to learn about and understand the most important topics and can then judge their importance for your work. With the extensive, up-to-date documentation you obtain a valuable and unique reference book for your daily work.

Who should attend?

The seminar addresses everybody who wants to obtain an up-to-date overview of this wide area. It is suited for novices in the field of Passive Safety of Vehicles such as university graduates, career changers, project assistants, internal service providers, but also for highly qualified technicians from the crash-test lab.

Course Contents

- Introduction to vehicle safety
  - Overview active and passive safety
  - Crash physics
- Accident research
  - General accident research
  - Classification
  - Statistics
- Biomechanics
  - Human anatomy
  - Injury mechanisms & injury criteria
- Dummy technology
- Crash testing
  - Crash test systems and components
  - Test methods
- Crash rules and regulations
  - Institutions
  - Rules and regulations
  - NCAP tests
  - Latest trends
- Protection principles, occupant protection systems
  - Protection principles of passive safety
  - Occupant protection systems
  - Passenger compartment, interior
  - OOP, pre crash, post crash, sensor system, vehicle body
  - Optimization of restraint systems, adaptive systems
  - Integrated safety

Instructor

Rainer Hoffmann (carhs.training gmbh) has been involved in automotive safety throughout his career. After graduating from Wayne State University, he joined Porsche as a research associate in passive safety. Mr. Hoffmann advanced safety simulation during his subsequent tenure at ESI Group where he introduced new techniques like airbag simulation, numerical airbag folding and FE dummy modeling. As the head of the simulation department of PARS (now Continental Safety Engineering), Mr. Hoffmann led the R&D efforts for some of the first series production side airbag developments. In 1994 Mr. Hoffmann founded EASi Engineering GmbH, which in 2006 was renamed to carhs GmbH. He has authored numerous technical papers and has been granted German and international patents in the automotive safety field.

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
15.-17.02.2017	3016	Tianjin	3 Days	6.900,- RMB	
25.-26.04.2017	2917	Landsberg am Lech	2 Days	1.290,- EUR till 28.03.2017, thereafter 1.540,- EUR	
13.-14.06.2017	2904	Alzenau	2 Days	1.290,- EUR till 16.05.2017, thereafter 1.540,- EUR	
06.-07.09.2017	2936	Tappenbeck	2 Days	1.290,- EUR till 09.08.2017, thereafter 1.540,- EUR	
30.10.-01.11.2017	3017	Tianjin	3 Days	6.900,- RMB	
20.-21.11.2017	2916	Alzenau	2 Days	1.290,- EUR till 23.10.2017, thereafter 1.540,- EUR	

International Safety and Crash-Test Regulations: Current Status and Future Developments

Course Description

Since the 1960's, the regulation of vehicle safety performance has had a major impact on vehicle and system design. As automotive manufacturing has evolved into an integrated global system, understanding and anticipating legal requirements has become an immense challenge. Regulators collaborate and diverge in how they address road-safety policy goals. Regulatory changes in a single market can translate into global customer requirements. And these requirements are continuously evolving. In a compact program, this two-day seminar provides a worldwide update on the passive safety landscape, covering local, national, regional, and international policy and rulemaking developments.

The first segment of the seminar focuses on regulatory institutions and processes. By understanding the regulatory environment, including the trend towards an integrated global regulatory system, businesses can better prepare for changes that impact competitiveness and customer satisfaction.

The second segment applies this knowledge to current and future regulatory requirements. The seminar covers crashworthiness (frontal, side, rear impact, etc.) as well as pedestrian protection and new technologies.

Course Objectives

This course informs participants of recent developments and discussions within the global regulatory community concerning passive safety. The seminar explores differences in regulatory systems and philosophies, in compliance and enforcement, and in the forces behind the regulation of vehicle safety. The course provides participants with a broad understanding current regulatory directions and guidance on how to follow, and even influence, future requirements.

Who should attend?

This seminar should be of interest to anyone involved with meeting and anticipating legal requirements for vehicle safety performance across international markets. The course provides a compact review of changes in passive safety requirements and current priorities across the international regulatory community. Moreover, the course provides knowledge critical to understanding differences in the way regulators establish and enforce these legal requirements.

Course Contents

- History of safety regulation and development of legal regimes (e.g., self-certification, type approval, product liability, in-use surveillance
- Regulatory agencies and rulemaking processes (e.g., UN World Forum for the Harmonization of Vehicle Regulations, European Commission, U.S. National Highway Traffic Safety Administration, etc.)
- Regulatory drivers and priorities (e.g., accident data, injury dynamics, injury assessment criteria, test tools, harmonization, whole vehicle approval, competitiveness, etc.)
- Types and purposes of regulations (UN Regulations, Global Technical Regulations, Federal Motor Vehicle Safety Standards, EU Regulations and Directives, etc.)
- Developments in crashworthiness and occupant protection requirements (frontal impact, side impact, pole-side impact, full width barrier, offset deformable barrier, mobile barrier, etc.)
- Vulnerable road user (VRU) protection (e.g., pedestrian safety, cyclist safety)
- Safety of new propulsion technologies (electric vehicles, hydrogen fuel-cells, minimum vehicle noise levels)
- Passive safety implications of new safety technologies (e.g., emergency call systems, collision avoidance, VRU detection, automated driving)

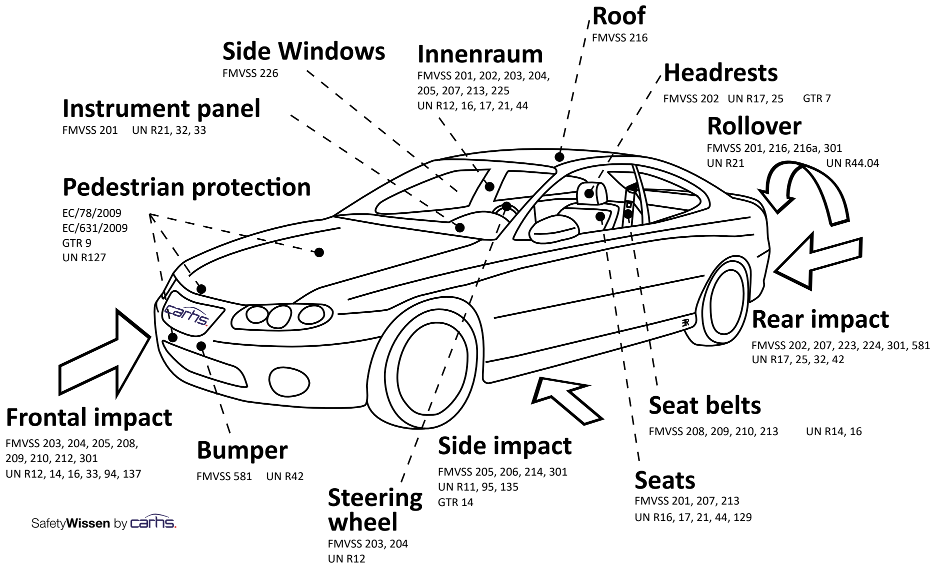
Instructor

John Creamer (GlobalAutoRegs.com) is the founder of GlobalAutoRegs.com and a partner in The Potomac Alliance, a Washington-based international regulatory affairs consultancy. In his client advisory role, Mr. Creamer is regularly involved with meetings of the UN World Forum for the Harmonization of Vehicle Regulations (WP.29). Previously, he has held positions with the US International Trade Commission and the Motor & Equipment Manufacturers Association (representing the US automotive supplier industry), as the representative of the US auto parts industry in Japan, and with TRW Inc. (a leading global automotive safety systems supplier).

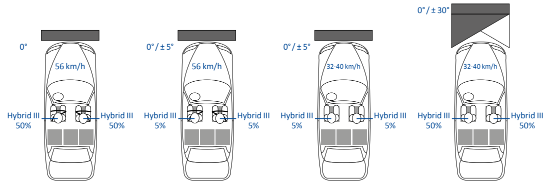
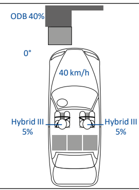
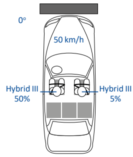
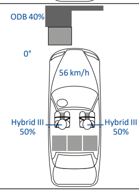
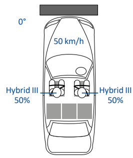
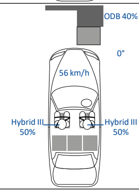
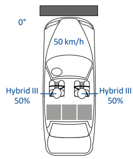
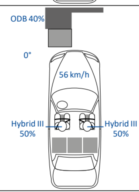
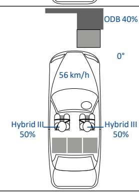
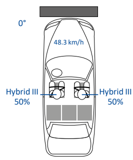
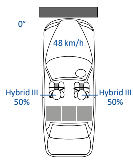
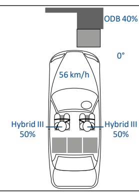
Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
09.-10.03.2017	2908	Alzenau	2 Days	1.290,- EUR till 09.02.2017, thereafter 1.540,- EUR	
28.-29.06.2017	2865	Alzenau	2 Days	1.290,- EUR till 31.05.2017, thereafter 1.540,- EUR	
14.-15.09.2017	2871	Alzenau	2 Days	1.290,- EUR till 17.08.2017, thereafter 1.540,- EUR	

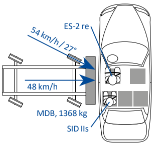
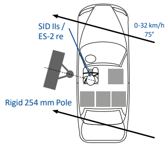
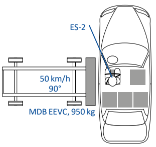
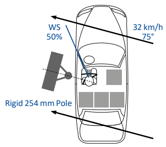
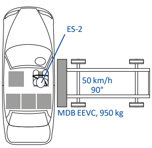
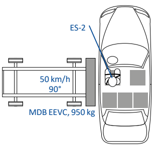
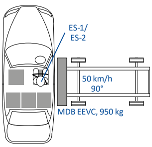
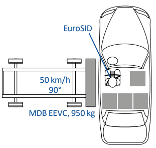
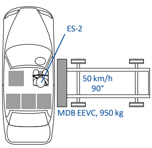
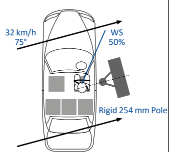
Crash-Regulations Europe, United Nations and USA



Rules and Regulations on Occupant Protection

	Full Width Frontal		Offset Frontal	
USA	FMVSS 208		FMVSS 208	
Europe	UN R137[1]		UN R94	
Japan	Art. 18 Attachmt. 23		Art 18	
China	GB 11551-2014		GB/T 20913-2007	
India			AIS-098/F	
South Korea	KMVSS 102			
Australia	ADR 69/00		ADR 73/00	

[1] Expected to become mandatory as part of the EU type appoval in 2020.

Side Barrier	Side Pole	Pedestrian	Rear	Head Impact	Rollover
FMVSS 214 	FMVSS 214 		FMVSS 202a FMVSS 301	FMVSS 201	Roof crush: FMVSS 216a Ejection Mitigation: FMVSS 226
UN R95 	UN R135[1] 	R (EC) 78/2009 R (EC) 631/2009 UN R127	UN R32	UN R21	
Art. 18 Attachmt. 24 		Article 18 Attachment 99	Article 18 Attachment 34		
GB 20071-2006 		GB/T 24550-2009	GB 20072-2006	GB11552-2009	Roof crush: GB26134-2010
AIS-099/F 		AIS-100	AIS-101		
KMVSS 102 		KMVSS 102-2			
ADR 72/00 	ADR 85/00 				

[1] Expected to become mandatory as part of the EU type appoval in 2020.

Crash Safety of Alternative Propulsion Vehicles

Course Description

During recent years, vehicles with alternative propulsion systems have achieved an ever-increasing importance for the automotive market. In addition to gas-powered vehicles, which have already been existing for many years on the manufacturer and retrofit market, a wide range of hybrid vehicles has also established meanwhile. Even for pure electric vehicles, the first acquirable products are already on the market. Worldwide over 1 million electrified vehicles were on the streets in 2015. By decision of the German government, one million electric vehicles should be found driving on German roads by the year 2020. It is clear, however, that the automotive electrification cannot be stopped anymore.

With this new technology, new challenges for vehicle safety arise.
Electric shock risks on high-voltages systems, fire hazards in case of lithium-ion batteries and risks of rupture in case of gas tanks are the most important issues here. For every mode of drive, specific drive components and their particular safety requirements are described. In addition to common rules and standards, specific needs based on real-life accidents are being discussed.

For all relevant vehicle components the respective safety requirements, safety concepts and exemplary safety initiatives will be discussed. The state of the art concerning test standards, verification methods and possibilities for virtual safety will be shown. Future trends will be presented with the help of current research projects and results. Practical experience of rescuing, recovering and towing of electric vehicles complete the spectrum of accident safety.

Course Objectives

Participants will get an overview about automotive safety for alternative drive systems and will learn the special challenges and solutions which come along. Participants will be able to apply test methods and safeguarding concepts and to pursue development strategies in a target-oriented way.

Who should attend?

The seminar addresses development and research engineers as well technicians in the fields of testing and engineering. Due to its current relevance the course suits young professionals as well as experienced engineers who want to deepen their knowledge in this field.

Course Contents

- Overview alternative propulsion systems: gas, hybrid, electric and fuel cell vehicles
- Challenges for vehicle safety
- Legal requirements and standards for safety
- Safety requirements for real-world accidents
- Safety of high voltage systems
- Battery safety
- Gas tank safety
- Fuel cell safety
- Structural safety
- Safety concepts
- Rescuing, recovering and towing of electric vehicles

Instructor

Rainer Justen (Daimler AG) has more than 25 years of experience in the field of vehicle safety. After his studies in mechanical engineering with a focus on automotive engineering he started his career in 1987 in the automotive development for Mercedes-Benz at Daimler AG. Several career milestones in the fields of vehicle safety, project management, safety concepts and active safety / driver assistance systems made him an expert on all relevant topics of automotive safety. Since 2008 he is working in the field of safety for alternative drive systems. Rainer Justen is author of numerous publications and papers on this topic. In 2015 Rainer Justen received the SAE Automotive Safety Award from the American Society of Automotive Engineers (SAE) for his work on the safety of Li-Ion batteries in electric vehicles.

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
22.-23.03.2017	2869	Alzenau	2 Days	1.290,- EUR till 22.02.2017, thereafter 1.540,- EUR	German
26.-27.06.2017	2907	Alzenau	2 Days	1.290,- EUR till 29.05.2017, thereafter 1.540,- EUR	English
06.-07.11.2017	2906	Alzenau	2 Days	1.290,- EUR till 09.10.2017, thereafter 1.540,- EUR	German

FMVSS 305: Safety Requirements for Electric Vehicles

Scope:

Cars, busses, trucks with a GVWR of 4536 kg or less that use electrical components with working voltages higher than 60 volts direct current (VDC) or 30 volts alternating current (VAC), and whose speed attainable is more than 40 km/h.

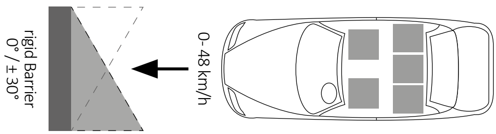
Requirements:

Under the test conditions described below (impact test and subsequent static rollover)

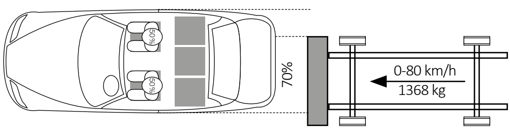
- max. 5 litres of electrolyte may spill from the batteries,
- there shall be no evidence of electrolyte leakage into the passenger compartments,
- all components of the electric energy storage/conversion system must be anchored to the vehicle,
- no battery system component that is located outside the passenger compartment shall enter the passenger compartment,
- electrical isolation must be greater than or equal to:
  - 500 ohms/V for all DC high voltage sources without isolation monitoring and for all AC high voltage sources,
  - 100 ohms/V for all DC high voltage sources with continuous monitoring of electrical isolation,
- the voltage of the voltage source (Vb, V1, V2) must be less than or equal to 30 VAC for AC components or 60 VDC for DC components.

Test Conditions:

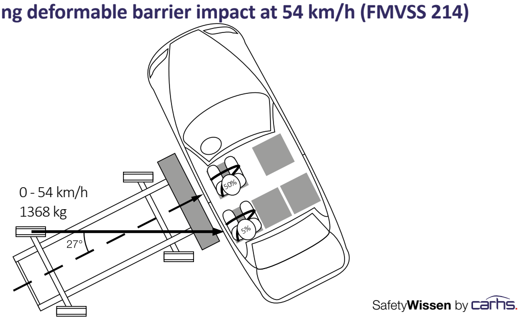
Frontal impact against a rigid barrier at 48 km/h



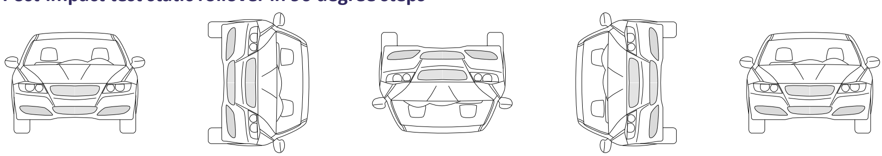
Rear moving barrier impact at 80 km/h (FMVSS 301)



Side moving deformable barrier impact at 54 km/h (FMVSS 214)

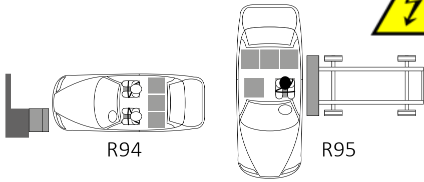


Post-impact test static rollover in 90 degree steps



UN ECE: Safety Requirements for Electric Vehicles

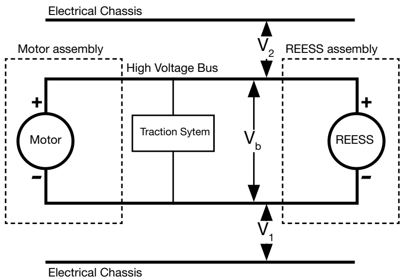
Extension of UN R94 / R95:



After crash tests according to UN R94 and R95 vehicles with a high voltage electrical powertrain (> 60 V DC or > 30 V AC) must meet the following requirements:

1. Protection against electrical shock

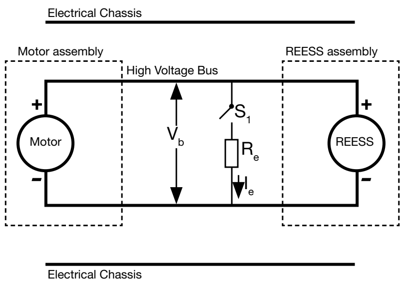
at least one of the four criteria specified below shall be met:



- Absence of high voltage:
  The voltages V_b, V_1 and V_2 shall be
  ≤ 30 V AC or ≤ 60 V DC :
- Low electrical energy:
  The total energy (TE) on the high voltage buses shall < 2.0 J.
  Prior to the impact a switch S_1 and a known discharge resistor R_e is connected in parallel to the relevant capacitance .
  Not earlier than 5 s and not later than 60 s after impact S_1 shall be closed while the voltage V_b and the current I_e are recorded.
  From this TE is caluclated as follows:

$$TE = \int_{tc}^{th} V_b \times I_e dt$$

with tc = time of closing S_1
th = time when voltage drops below 60 V DC



- Physical protection:
  For protection against direct contact with high voltage live parts, the protection IPXXB shall be provided.
- Isolation resistance:
  - If the AC HV buses and the DC high voltage buses are galvanically isolated from each other, isolation resistance between the HV bus and the electrical chassis shall be ≥ 100 Ω/V of the working voltage for DC buses, and ≥ 500 Ω/V of the working voltage for AC buses.
  - If the AC HV buses and the DC HV buses are galvanically connected isolation resistance between the HV bus and the electrical chassis shall be ≥ 500 Ω/V of the working voltage. (if the protection IPXXB is satisfied for all AC HV buses or the AC voltage is ≤ 30 V after the vehicle impact, the isolation resistance shall be R_i ≥ 100 Ohm/V)

2. Electrolyte spillage

- In the period from the impact until 30 minutes after no electrolyte from the REESS (Rechargeable Electrical Energy Storage System) shall spill into the passenger compartment and no more than 7 % of electrolyte shall spill from the REESS.

3. REESS retention

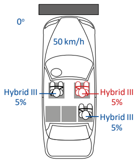
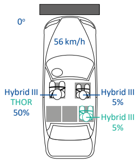
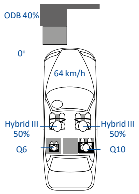
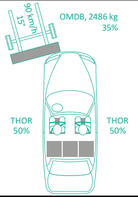
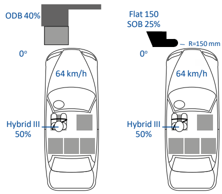
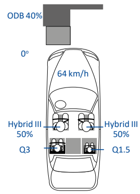
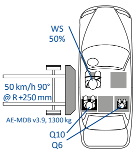
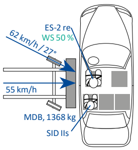
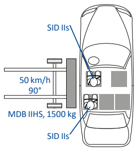
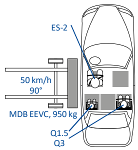
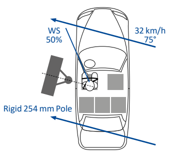
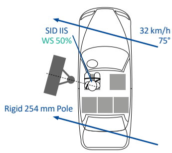
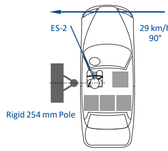
REESS located inside the passenger compartment shall remain in the location in which they are installed and REESS components shall remain inside REESS boundaries. No part of any REESS that is located outside the passenger compartment for electric safety assessment shall enter the passenger compartment during or after the impact test.

UN R100:

M and N class vehicles with a maximum speed > 25 km/h must also comply with UN R100 Rev. 2

NCAP-Tests in Europe and America

2017 2018

	Euro NCAP	U.S. NCAP	IIHS	Latin NCAP
Full Width			Get familiar with all NCAP tests in just 2 days with our seminar: **NCAP - New Car Assessment Programs: Tests, Assessment Methods, Ratings** learn more on ➲ page 118	
ODB / SOB				
MDB	 ■ Far Side Occupant Protection			
Pole				 (prerequisite for 5 star rating)
Rollover		■ SSF	■ Roof Crush	
Pedestrian	■ Flex PLI ■ Upper Legfom ■ Headforms ■ AEB VRU Pedestrian ■ AEB VRU Cyclist	■ Flex PLI ■ Upper Legfom ■ Headforms ■ AEB Pedestrian ■ Rear Automatic Braking		■ Award
Child Safety	■ Frontal ODB ■ Side MDB ■ CRS- Installation ■ Vehicle based assessment		■ LATCH (Lower Anchors and Tethers for Children)	■ Frontal ODB ■ Side MDB ■ CRS- Installation ■ Vehicle based assessment
Whiplash	■ static front / rear ■ dynamic (3 pulses) ■ AEB City		■ static ■ dynamic (1 pulse)	SafetyWissen by carhs.
Other	■ Assistance systems: SBR, SAS, AEB, LDW, LKA ...	■ FCW, LDW, Rear View Cameras, AEB, DBS, BSD	■ AEB, FCW ■ Headlights	■ SBR, ABS (prerequisite for ≥ 3 star rating) ■ ESC (prereq. f. ≥ 4 star)
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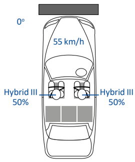
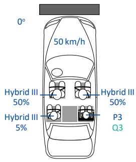
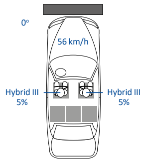
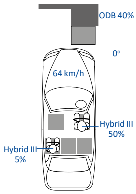
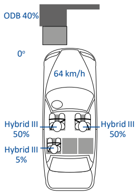
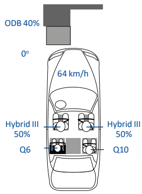
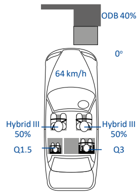
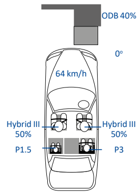
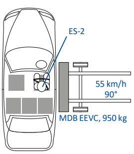
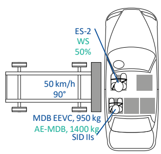
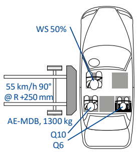
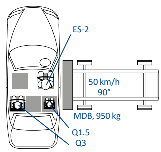
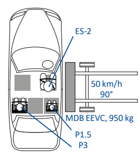
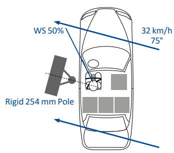
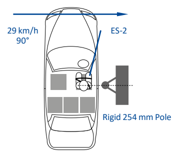
NCAP-Tests in Asia and Australia

2017 2018

	JNCAP	C-NCAP	KNCAP	ASEAN NCAP	ANCAP
Full Width					
ODB / SOB					
MDB					
Pole					
Rollover		■ Curtain Airbag	■ SSF		
Pedestrian	■ Flex PLI ■ Headforms ■ AEB Pedestrian	■ Flex PLI ■ Headforms ■ AEB VRU Pedestrian	■ Flex PLI ■ Upper Legform (on bumper only) ■ Headforms ■ AEB Pedestrian		■ Flex PLI ■ Upper Legform ■ Headforms
Child Safety		■ P3 in Full Width Frontal	■ Q6, Q10 in ODB and MDB	■ Frontal ODB ■ Side MDB ■ CRS- Installation ■ Vehicle based assessm.	■ ODB, MDB (no assessment)
Whiplash	■ dynamic (1 pulse)	■ dynamic (1 pulse)	■ static ■ dynamic (1 pulse) ■ rear seats dynamic		■ static ■ dynamic (1 pulse)
Other	■ SBR, Usability rear belts, LDW, AEB, LKA, Rear View Monitor	■ ESC ■ SBR ■ AEB, FCW	■ Brakes, SBR, FCWS, LDWS, SLD, AEB, BSD, ASCC, LKAS RCTA, ISA	■ Safety Assist Technologies	■ Assistance systems SafetyWissen by carhs.
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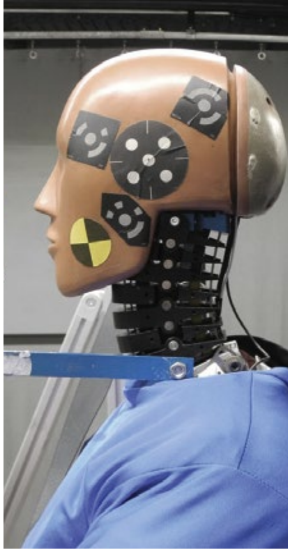
Euro NCAP
Protection Criteria in Frontal Impact

Assessment Protocol Version 7.0.3

Dummy	Region	Criteria	4 Points	0 Points	Modifiers
Frontal-Impact on ODB with 40 % overlap @ 64 km/h					
Hybrid III 50 %	Head[1] Neck	HIC_{15}	< 500	> 700	Unstable airbag/steering wheel contact (-1 pt) Hazardous airbag deployment (-1 pt) Incorrect airbag deployment (-1 pt) Steering column displacement (-1 pt)
		a_{3ms} (g)	< 72	> 80	
		$M_{y,extension}$ (Nm)	< 42	> 57	
		$F_{z,tension}$ (kN)	< 2.7 @ 0 ms	> 3.3 @ 0 ms	
			< 2.3 @ 35 ms	> 2.9 @ 35 ms	
			< 1.1 @ 60 ms	> 1.1 @ 60 ms	
		$F_{x,shear}$ (kN)	< 1.9 @ 0 ms	> 3.1 @ 0 ms	
			< 1.2 @ 25-35 ms	> 1.5 @ 25-35 ms	
			< 1.1 @ 45 ms	> 1.1 @ 45 ms	
	Chest	Deflection (mm)	< 22	> 42	A-pillar displacement (-2 pt) Compartment deformed (-1 pt) Steering wheel contact (-1 pt) Incorrect airbag deployment (-1 pt) Shoulder belt load > 6 kN (-2 pt)
		VC (m/s)	< 0.5	> 1.0	
	Femur Knee	Axial Force (kN)	< 3.8	> 9.07 > 7.56 @ 10 ms	Variable contact (-1 pt) Concentrated loading (-1 pt) Incorrect airbag deployment (-1 pt)
		Displacement (mm)	< 6	>15	
	Tibia Foot	Tibia Index	< 0.4	> 1.3	Z–displacement of worst pedal (-1 pt)
		Axial Force (kN)	< 2	> 8	
		x–Displacement pedal (mm)	< 100	> 200	Footwell rupture (-1 pt) Pedal blocking (-1 pt)
Frontal-Impact on Rigid Wall with 100 % overlap @ 50 km/h					
Hybrid III 5 %	Head[1]	HIC_{15}	< 500	> 700	Unstable airbag/steering wheel contact (-1 pt) Hazardous airbag deployment (-1 pt) Incorrect airbag deployment (-1 pt) Steering column displacement (-1 pt) Rear seat: head forward excursion (-4 pt)
		a_{3ms} (g)	< 72	> 80	
	Neck	$M_{y,extension}$ (Nm)	< 36	> 49	
		$F_{z,tension}$ (kN)	< 1.7	> 2.62	
		$F_{x,shear}$ (kN)	< 1.2	> 1.95	
	Chest	Deflection (mm)	< 18	> 42	Steering wheel contact (-1 pt) Incorrect airbag deployment (-1 pt) Shoulder belt load > 6.0 kN (-2 pt)
		VC (m/s)	< 0.5	> 1.0	
	Femur	Axial Force (kN)	< 2.6	> 6.2	Submarining (-4 pt)

[1] If there is no hard contact (i.e. $a_{res, peak} < 80$ g and no other evidence of hard contact) a score of 4 points is awarded.


ADAC



Euro NCAP

Assessment Protocol Version 7.0.3

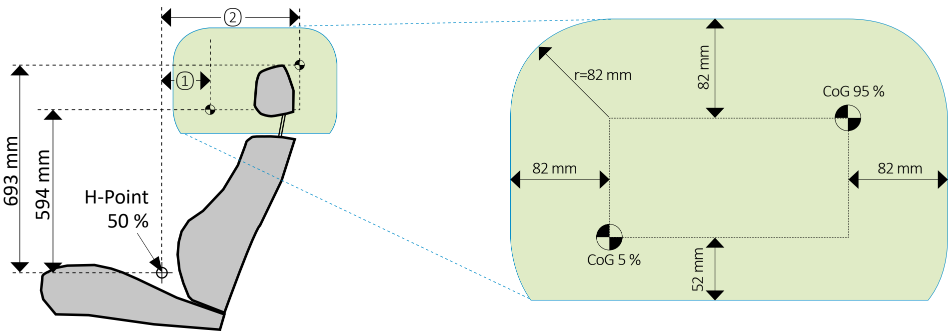
Protection Criteria in Side Impact (MDB and Pole)

Dummy	Region	Criteria	4 Points	0 Points	Modifiers
Barrier-Side-Impact (AE-MDB) @ 50 km/h & Pole-Side-Impact under 75° @ 32 km/h					
World SID 50 %	Head[2]	HIC_{15}	< 500	> 700	incorrect airbag deployment (-1 point) door opening (- 1 point/door) lateral shoulder force > 3.0 kN (deduction of all chest points) VC > 1.0 m/s (deduction of all chest/ abdomen points) head protection device assessment (-4 points)
		a_{3ms} (g)	< 72	> 80	
	Chest	Deflection (mm)	< 28	> 50	
	Abdomen	Deflection (mm)	< 47	> 65	
	Pelvis	Pubic Symphysis Peak Force (kN)	< 1.7	> 2.8	

[1] Pole: no sliding scale, only capping if $HIC_{15} > 700$ or $a_{res,\ peak} > 80$ g or direct head contact with the pole.

Modifier Side Head Protection Device

Inside the ‚Head Protection Device Assessment Zone' (green) the head protection system's coverage is assessed. If the coverage is insufficient a 4 point modifier is applied the overall pole impact score. Areas outside the Daylight Opening (FMVSS 201) are excluded from assessment. Seams are not penalized if the un-inflated area is no wider than 15 mm. Any other un-inflated areas that are no larger than 50 mm in diameter (or equivalent area) are not penalized.



The head protection device (HPD) evaluation zone (green) is defined as a rounded rectangle around the head CoG box (defined by the head CoGs of the 5 % female and 95 % male occupants) at a distance of 82 mm from the upper and fore/aft edges and 52 mm below the bottom edge. The x-position of the CoG is defined relative to the H-Point of the 50 % male:

Front seats:

① = H-Point(x) + 126 mm - seat travel(5^{th} %ile- 50^{th} %ile)

② = H-Point(x) + 147 mm + seat travel(50^{th} %ile- 95^{th} %ile)

Rear seats:

① = H-Point(x) + 126 mm - seat travel

② = H-Point(x) + 147 mm

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Euro NCAP Rating: 2017 - 2020

Adult Occupant Protection

	2017	2018	2020
	max. points		
Offset Frontal impact ➲ Page 26	8	8	8
Full-width Frontal impact ➲ Page 26	8	8	8
Side impact (MDB) ➲ Page 28	8	8	8
Side impact (Pole) ➲ Page 28	8	8	8
Whiplash Front seats ➲ Page 85	2	**1.5**	1.5
Whiplash Rear seats ➲ Page 84	1	**0.5**	0.5
AEB City ➲ Page 120	3	**4**	4
max. points (1)	38	38	38
normalised score (2)	actual points / (1)		
weighting (3)	40 %		
weighted score (4)	(2)x(3)		
★★★★★	80 %	80 %	80 %
★★★★	70 %	70 %	70 %
★★★	**60 %**	60 %	60 %
★★	**50 %**	50 %	50 %
★	**40 %**	40 %	40 %

Child Occupant Protection

	2017	2018	2020
	max. points		
Dyn. Tests Frontal ➲ Page 87	16	16	16
Dyn. Tests Side ➲ Page 87	8	8	8
CRS Installation ➲ Page 87	12	12	12
Vehicle based ➲ Page 87	13	13	13
max. points (1)	49	49	49
normalised score (2)	actual points / (1)		
weighting (3)	20 %		
weighted score (4)	(2)x(3)		
+	75 %	**80 %**	80 %
	60 %	**70 %**	70 %
	30 %	**60 %**	60 %
	25 %	**50 %**	50 %
	15 %	**40 %**	40 %

Pedestrian Protection

	2017	2018	2020
	max. points		
Head Impact ➲ Page 78	24	24	24
Leg Impact ➲ Page 78	6	6	6
Upper Leg Impact ➲ Page 78	6	6	6
AEB VRU-Pe ➲ Page 122	**6**	6	6
AEB VRU-Cy ➲ Page 124	-	**6**	6
max. points (1)	**42**	**48**	48
normalised score (2)	actual points / (1)		
weighting (3)	20 %		
weighted score (4)	(2)x(3)		
+	**60 %**	60 %	60 %
	50 %	50 %	50 %
	40 %	40 %	40 %
	30 %	30 %	30 %
	20 %	20 %	20 %

Safety Assist

	2017	2018	2020
	max. points		
Seat Belt Reminder ➲ Page 110	3	3	3
Speed Assistance Syst. ➲ Page 110	3	3	3
LDW / LKD / LSS ➲ Page 110	**3**	**4**	4
AEB Inter-Urban ➲ Page 126	3	3	**4**
Junction Assist			**2**
max. points (1)	**12**	**13**	**16**
normalised score (2)	actual points / (1)		
weighting (3)	20 %		
weighted score (4)	(2)x(3)		
+	**50 %**	**70 %**	70 %
	40 %	**60 %**	60 %
	25 %	**50 %**	50 %
	15 %	**40 %**	40 %
	10 %	**30 %**	30 %

Balancing: minimum normalised score (2) by box for the respective star rating (star rows above).

Overall score (5) = ∑(4)

The overall score is used only for ranking the results within vehicle categories.

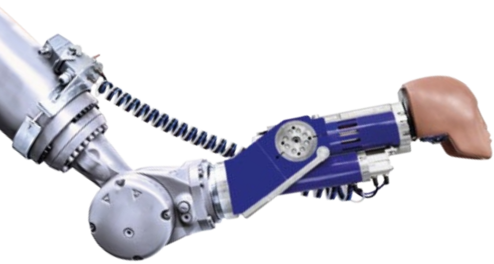
Bold figures indicate changes with respect to the previous year

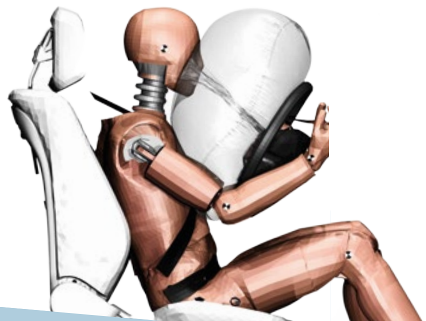
Euro NCAP Logo Guidelines

VSSTR Protocol Version 7.0

Dual Rating

Euro NCAP issues a base rating for standard equipment only. Fitments rates for safety assist technologies are no longer considered. Optionally manufacturers of cars that have achieved at least 3 stars can apply for a secondary rating of a model equipped with an optional safety package that meets a certain market installation rate (an average of 25 % in the first 3 years and of 55 % in the subsequent 3 years). The safety package must be actively promoted by the manufacturer. The safety package must be available, at least as an option, on all variants in the model range.





Knee Mapping Workshop: The Euro NCAP Test Procedure

Course Description

Euro NCAP plays a leading role among the tests assessing the passive safety of vehicles in Europe. Its influence now also extends to other countries. Recently the knee impact test procedure within the Euro NCAP frontal impact test was modified, the goal being a less subjective assessment. A hard contact or a sharp edge in the knee area implies the danger for a car manufacturer to be punished with a so-called knee modifier (reduction in points). The knee modifier is the most frequent penalty within the Euro NCAP and impairs some vehicles' otherwise 5-star ratings. The allocation of a knee modifier often is a controversial decision. If a knee modifier has been allocated by the Euro NCAP inspector the car manufacturer has the possibility of proving - by means of a complex sled test procedure - that the modifier was not justified.

After a short introduction the main focus of the workshop is on the current Euro NCAP assessment procedure for frontal impact in the knee area (knee mapping). The current requirements will be explained in detail, in particular the knee modifiers 'Variable Contact' and 'Concentrated Loading', the areas of inspection and the threshold values. Positive / negative examples will facilitate the participants' understanding of the requirements and the assessment procedure. Participants will learn how to avoid a modifier. The sled test procedure will also be explained and discussed in detail.

In the afternoon a demo vehicle, which can be provided by participants, will be analyzed. Ralf Ambos, a trained Euro NCAP inspector, can give valuable hints here.

A perspective regarding the future development of the test procedure will be given at the end of the seminar.

Who should attend?

The seminar addresses specialists from the field of crash, engineers and technicians from numerical simulation and testing, project engineers and managers who want to have a first-hand, up-to-date information and hints on how to avoid knee modifiers in Euro NCAP.

Course Contents

- Overview of Euro NCAP crash tests
- Euro NCAP requirements in the knee area
- Knee modifier, knee mapping test procedure
- Sled test procedure for knee impact
- Discussion of the assessment procedure and possibilities of interpretation
- Workshop with analysis of test vehicles, which can be provided by participants
- Future development of the test procedure

> *The workshop was very informative and relevant. The final analysis of a test vehicle was very helpful."*
>
> **Ray Longbottom,**
> **SAIC Motor UK Technical Centre Ltd., UK**

Instructor

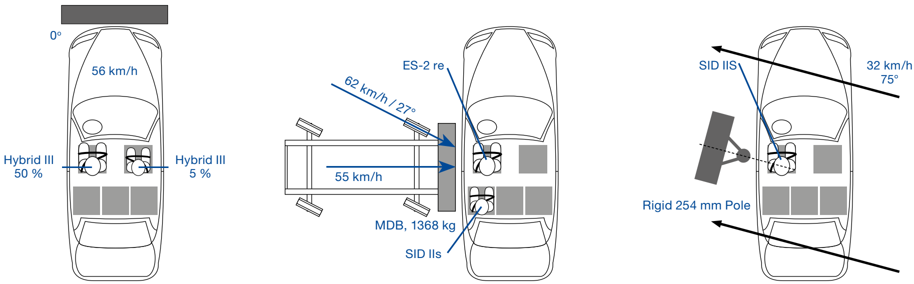
Ralf Ambos (DEKRA Automobil GmbH) studied automotive technology at the university for technology and economy in Dresden, Germany. He has worked as a project manager in passive vehicle safety for eight years. In 2004 he was trained as an inspector for Euro NCAP. In 2009 he joined DEKRA Automobil GmbH.

Date

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
11.09.2017	2861	Alzenau	1 Day	740,- EUR till 14.08.2017, thereafter 890,- EUR	German (flag)

U.S. NCAP Tests and Criteria

Docket No. NHTSA–2006–26555



Injury Criteria — Injury Risk Curves

Frontal Impact Rigid Wall 100 % Overlap / 56 km/h

Dummy	Hybrid III 50 % (Driver)	Hybrid III 5 % (Passenger)
Head (HIC_{15})	$P_{head}(AIS3+) = \Phi\left(\frac{\ln(HIC15) - 7.45231}{0.73998}\right)$ *where* Φ = cumulative normal distribution	$P_{head}(AIS3+) = \Phi\left(\frac{\ln(HIC15) - 7.45231}{0.73998}\right)$ *where* Φ = cumulative normal distribution
Chest (Deflection in mm)	$P_{chest\_defl}(AIS3+) = \frac{1}{1+e^{10.5456-1.568*(ChestDefl)^{0.4612}}}$	$P_{chest\_defl}(AIS3+) = \frac{1}{1+e^{10.5456-1.7212*(ChestDefl)^{0.4612}}}$
Femur (Force in kN)	$P(AIS\ 2+) = \frac{1}{1+e^{5.795-0.5196\,Femur\_Force}}$	$P(AIS\ 2+) = \frac{1}{1+e^{5.7949-0.7619\,Femur\_Force}}$
Neck (N_{ij} and Tension/ Compression in kN)	$P_{neck\_Nij}(AIS3+) = \frac{1}{1+e^{3.2269-1.9688\,Nij}}$ $P_{neck\_Tens}(AIS3+) = \frac{1}{1+e^{10.9745-2.375\,Neck\_Tension}}$ $P_{neck\_Comp}(AIS3+) = \frac{1}{1+e^{10.9745-2.375\,Neck\_Compression}}$ $P_{neck} = \max imum(P_{neck\_Nij}, P_{neck\_Tens}, P_{neck\_Comp})$	$P_{neck\_Nij}(AIS3+) = \frac{1}{1+e^{3.2269-1.9688\,Nij}}$ $P_{neck\_Tens}(AIS3+) = \frac{1}{1+e^{10.958-3.770\,Neck\_Tension}}$ $P_{neck\_Comp}(AIS3+) = \frac{1}{1+e^{10.958-3.770\,Neck\_Compression}}$ $P_{neck} = \max imum(P_{neck\_Nij}, P_{neck\_Tens}, P_{neck\_Comp})$
Overall	$P_{joint} = 1 - (1-P_{head}) \times (1-P_{neck}) \times (1-P_{chest}) \times (1-P_{femur})$	

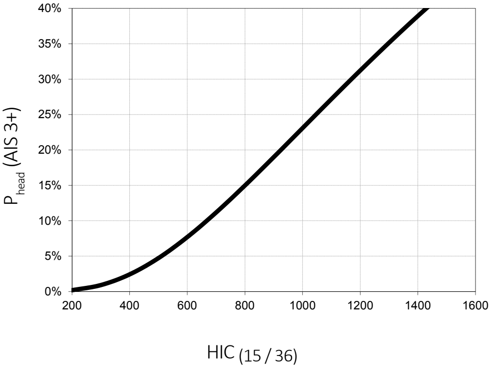
Side Impact (MDB & Pole Test)

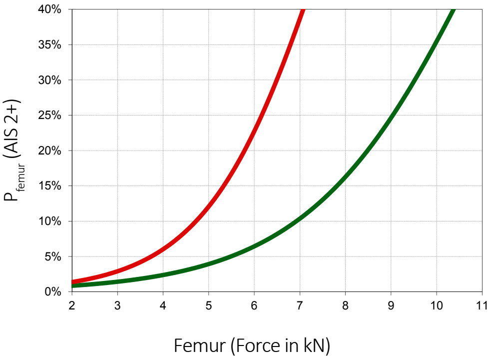
	ES-2re 50 %	SID-IIs 5 %
Head (HIC_{36})	$P_{head}(AIS3+) = \Phi\left(\frac{\ln(HIC36) - 7.45231}{0.73998}\right)$ *where* Φ = cumulative normal distribution	$P_{head}(AIS3+) = \Phi\left(\frac{\ln(HIC36) - 7.45231}{0.73998}\right)$ *where* Φ = cumulative normal distribution
Chest (Rib Deflection in mm)	$P_{chest}(AIS3+) = \frac{1}{1+e^{5.3895-0.0919*\max.\,rib\ deflection}}$	
Abdomen (Abdominal Force in N)	$P_{abdomen}(AIS3+) = \frac{1}{1+e^{6.04044-0.002133*F}}$ *where F = total abdominal force (N) in ES-2re*	
Pelvis (Force in N)	$P_{pelvis}(AIS3+) = \frac{1}{1+e^{7.5969-0.0011*F}}$ *where F is the pubic force in the ES-2re in Newtons*	$P_{pelvis}(AIS2+) = \frac{1}{1+e^{6.3055-0.00094*F}}$ *where F is the sum of acetabular and iliac force in the SID – IIs dummy in Newtons*
Overall	$P_{joint} = 1 - (1-P_{head}) \times (1-P_{chest}) \times (1-P_{abdomen}) \times (1-P_{pelvis})$	$P_{joint} = 1 - (1-P_{head}) \times (1-P_{pelvis})$

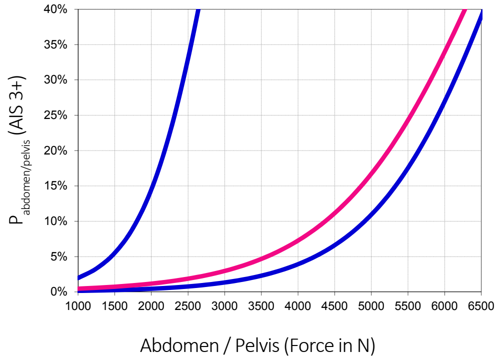
U.S. NCAP: Injury Risk Curves

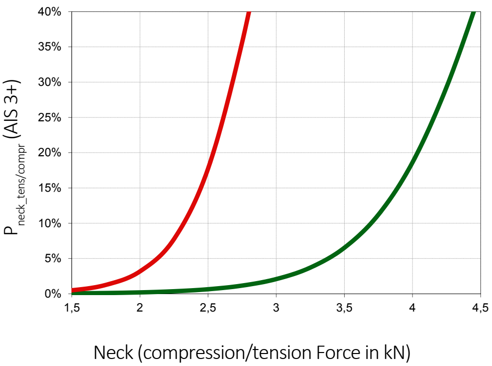
Hybrid III 50 %
Hybrid III 5 %
multiple Dummys
ES-2re 50 %
SID-IIs 5 %

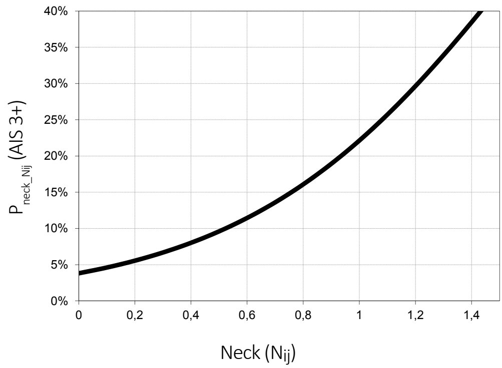
SafetyWissen by carhs.











U.S. NCAP: Rating Scheme

Frontal Crash Test		Side Pole Test	Side MDB Test		Rollover Test
Driver	Passenger	Front Seat	Front Seat	Rear Seat	
Injury Criteria ▼	Injury Criteria ▼	Injury Criteria ▼	Injury Criteria ▼	Injury Criteria ▼	
Probabilty of Injury (Risk Curves) P_{joint} ▼	Probabilty of Injury (Risk Curves) P_{joint} ▼	Probabilty of Injury (Risk Curves) P_{joint} ▼	Probabilty of Injury (Risk Curves) P_{joint} ▼	Probabilty of Injury (Risk Curves) P_{joint} ▼	Probabilty of Rollover P_{roll} ▼
$RR^{*}=P_{joint}/base^{**}$ ▼	$RR^{*}=P_{joint}/base^{**}$ ▼	$RR^{*}=P_{joint}/base^{**}$ ▼	$RR^{*}=P_{joint}/base^{**}$ ▼	$RR^{*}=P_{joint}/base^{**}$ ▼	$RR^{*}=P_{roll}/base^{**}$ ▼
Driver Stars (50 %) ▼	Passenger Stars (50 %) ▼	Stars (20 %) ▼	Stars (80 %) ▼	Rear Seat Stars (50 %) ▼	Overall Rollover Star Rating (3/12)
		Front Seat Stars (50 %) ▼			
Overall Frontal Star Rating (5/12)		Overall Side Star Rating (4/12)			
Vehicle Safety Score (VSS)					

SafetyWissen by carhs.

*RR = relative risk; **base = baseline risk = 15 %

Rating procedure

Using the Injury Risk Curves on ➲ page 33 and page 34, the risk of a serious injury (AIS 3+) can be calculated from the injury criteria measured in the crash test. The joint risk for an occupant can be determined using the following formulae:

Frontal Impact: $P_{joint} = 1 - (1 - P_{head}) \times (1 - P_{neck}) \times (1 - P_{chest}) \times (1 - P_{femur})$

Side Impact: $P_{joint} = 1-(1- P_{head}) \times (1- P_{chest}) \times (1- P_{abdomen}) \times (1- P_{pelvis})$

This risk is compared to a so called baseline risk which was set to 15 %. This ratio is called relative risk (RR) from which the star rating is determined using the following table:

RR	0 – 0.67	0.67 – 1	1 – 1.33	1.33 – 2.67	2.67 –
Stars	★★★★★	★★★★	★★★	★★	★

IIHS Rating

Testing Protocol Version XVII (Nov 2016)

Rating Guidelines September 2014

Dummy	Region	Criteria	Good	Acceptable	Marginal	Poor
Frontal Impact with 40 % Overlap @ 64 km/h						
H III 50 %	Head & Neck	HIC_{15}	≤ 560	≤ 700	≤ 840	> 840
		N_{ij}	≤ 0.80	≤ 1.00	≤ 1.20	> 1.20
		$F_{z,tension}$ (kN)	≤ 2.6	≤ 3.3	≤ 4.0	> 4.0
		$F_{z,compression}$ (kN)	≤ 3.2	≤ 4.0	≤ 4.8	> 4.8
		$a_{res\ peak}$ (g)	Values > 70 result in downgrading			
	Chest	a_{3ms} (g)	≤ 60	≤ 75	≤ 90	> 90
		Deflection (mm)	≤ 50	≤ 60	≤ 75	> 75
		Deflection rate (m/s)	≤ 6.6	≤ 8.2	≤ 9.8	> 9.8
		VC (m/s)	≤ 0.8	≤ 1.0	≤ 1.2	> 1.2
	Legs & Feet	Femur Axial Force (kN) (Force duration corridors)	≤ 7.3 @ 0 ms ≤ 6.1 @ 10 ms	≤ 9.1 @ 0 ms ≤ 7.6 @ 10 ms	≤ 10.9 @ 0 ms ≤ 9.1 @ 10 ms	> 10.9 @ 0 ms > 9.1 @ 10 ms
		Knee Displacement (mm)	≤ 12	≤ 15	≤ 18	> 18
		TI (upper, lower)	≤ 0.80	≤ 1.00	≤ 1.20	> 1.20
		Tibia Axial Force (kN)	≤ 4.0	≤ 6.0	≤ 8.0	> 8.0
		Foot acceleration (g)	≤ 150	≤ 200	≤ 260	> 260

Testing Protocol Version IV (Feb 2016)

Dummy	Region	Criteria	Good	Acceptable	Marginal	Poor
Seat/Head Restraints: Static Assessment (➲ page 85)						
HRMD	Head & Neck	Backset (mm)	≤ 70	≤ 90	≤ 110	> 110
		Distance from top of head (mm)	≤ 60	≤ 80	≤ 100	> 100
Seat/Head Restraints: Dynamic Assessment						
BioRID IIg	Head & Neck	Vector sum of the standardized shear (FX) and tension (FZ) values $\{F_x / 315\}^2 + \{(F_z - 234) / 1131\}^2$	< $\{0.450\}^2$	≤ $\{0.825\}^2$	> $\{0.825\}^2$	
		Time to head restraint contact (ms)	for values > 70 ms the rating is reduced by one level*			
		T1 acceleration (g)	for values > 9.5 the rating is reduced by one level*			
			* only if both exceed the given level			

The overall rating equals the static or dynamic rating. whichever is worse. Exceptions:
If the static rating is „acceptable“ but the backset is sufficient for a „good“ rating and the dynamic rating is „good“ then the overall rating is also „good“. If the static rating is „marginal“ or „poor“ no dynamic test is made and the overall rating is „poor“.

IIHS Rating

Rating Guidelines Nov 2016 | Testing Protocol Version IX (Nov 2016)

Dummy	Region	Criteria	Good	Acceptable	Marginal	Poor
Barrier Side Impact (IIHS MDB) @ 50 km/h						
SID-IIs 5 %	Head/ Neck	HIC_{15}	≤ 623	≤ 779	≤ 935	> 935
		$F_{z,tension}$ (kN)	≤ 2.1	≤ 2.5	≤ 2.9	> 2.9
		$F_{z,compression}$ (kN)	≤ 2.5	≤ 3.0	≤ 3.5	> 3.5
	Chest/ Torso	Shoulder deflection (mm)	Values > 60 result in downgrading			
		Ø Rib deflection (mm)	≤ 34	≤ 42	≤ 50	> 50
		Worst Rib deflection (mm)			51 - 55	> 55
		Deflection rate (m/s)	≤ 8.20	≤ 9.84	≤ 11.48	> 11.48
		VC (m/s)	≤ 1.00	≤ 1.20	≤ 1.40	> 1.40
	Pelvis/ Left Femur	Acetabulum force (kN)	≤ 4.0	≤ 4.8	≤ 5.6	> 5.6
		Ilium force (kN)	≤ 4.0	≤ 4.8	≤ 5.6	> 5.6
		Combined acetabulum and ilium force (kN)	≤ 5.1	≤ 6.1	≤ 7.1	> 7.1
		Femur A-P force (3 ms clip, kN)	≤ 2.8	≤ 3.4	≤ 3.9	> 3.9
		Femur L-M force (3 ms clip, kN)	≤ 2.8	≤ 3.4	≤ 3.9	> 3.9
		Femur A-P bending moment (3 ms clip, Nm)	≤ 254	≤ 305	≤ 356	> 356
		Femur L-M bending moment (3 ms clip, Nm)	≤ 254	≤ 305	≤ 356	> 356
Structure		Intrusion: B-pillar to driver seat centerline distance (mm)	≥ 125	≥ 50	≥ 0	< 0

Testing Protocol Version III (July 2016)

	Criteria	Good	Acceptable	Marginal	Poor
Roof Crush (➲ page 56)					
Stiffness to weight ratio (SWR)	F_{max} / m x g	≥ 4.00	≥ 3.25	≥ 2.50	< 2.5

IIHS TOP SAFETY PICK | **IIHS TOP SAFETY PICK+**

Year	TSP Criteria	TSP+ Criteria
2017	▪ „Good“ rating in all crash tests ▪ at least „advanced“ rating in front crash prevention ➲ Page 112	▪ „Good“ rating in all crash tests ▪ at least „advanced“ rating in front crash prevention ➲ Page 112 ▪ at least „acceptable“ rating for advanced headlights

IIHS Rating: Small Overlap

Testing Protocol Version V (Nov 2016)

Rating Protocol Version IV (Nov 2014)

Dummy	Region	Criteria	Good	Acceptable	Marginal	Poor
Small Overlap Frontal Impact with 25 % Overlap @ 64 km/h						
Structure Rating: Intrusions (mm) ❶	Lower Occupant Compartment	lower hinge pillar (resultant)	≤ 150	≤ 225	≤ 300	> 300
		footrest (resultant)				
		left toepan (resultant)				
		brake pedal (resultant)				
		parking brake pedal (resultant)				
		rocker panel (lateral)	≤ 50	≤ 100	≤ 150	> 150
	Upper Occupant Compartment	steering column (longitutinal)	≤ 50	≤ 100	≤ 150	> 150
		upper hinge pillar (resultant)	≤ 75	≤ 125	≤ 175	> 175
		upper dash (resultant)				
		left instrument panel (resultant)				
H III 50 %	Head & Neck ❷	HIC_{15}	≤ 560	≤ 700	≤ 840	> 840
		N_{ij}	≤ 0.80	≤ 1.00	≤ 1.20	> 1.20
		$F_{z,tension}$ (kN)	≤ 2.6	≤ 3.3	≤ 4.0	> 4.0
		$F_{z,compression}$ (kN)	≤ 3.2	≤ 4.0	≤ 4.8	> 4.8
	Chest/ Torso ❸	a_{3ms} (g)	≤ 60	≤ 75	≤ 90	> 90
		Deflection (mm)	≤ 50	≤ 60	≤ 75	> 75
		Deflection rate (m/s)	≤ 6.6	≤ 8.2	≤ 9.8	> 9.8
		VC (m/s)	≤ 0.8	≤ 1.0	≤ 1.2	> 1.2
	Femur ❹	KTH Injury Risk (%)	≤ 5	≤ 15	≤ 25	> 25
	Leg & Foot ❺	Knee Displacement (mm)	≤ 12	≤ 15	≤ 18	> 18
		TI (upper, lower)	≤ 0.80	≤ 1.00	≤ 1.20	> 1.20
		Tibia Axial Force (kN)	≤ 4.0	≤ 6.0	≤ 8.0	> 8.0
		Foot Acceleration (g)	≤ 150	≤ 200	≤ 260	> 260

IIHS Rating: Small Overlap

Small Overlap Frontal Impact with 25 % Overlap @ 64 km/h	
Restraints & Dummy Kinematics Rating	SafetyWissen by carhs.
Rating system based on a demerit system	**Demerits**
Frontal Head Protection	
Partial frontal airbag interaction	**1**
Minimal frontal airbag interaction	**2**
Excessive lateral steering wheel movement (>100 mm)	**1**
Two or more head contacts with structure	**1**
Late deployment or non deployment of frontal airbag	**automatic Poor**
Lateral Head Protection	
Side head protection airbag deployment with limited forward coverage	**1**
No side head protection airbag deployment	**2**
Excessive head lateral movement	**1**
Front Chest Protection	
Excessive vertical steering wheel movement (>100 mm)	**1**
Excessive lateral steering wheel movement (>150 mm)	**1**
Occupant containment and miscellaneous	
Excessive occupant forward excursion (>250 mm)	**1**
Occupant burn risk	**1**
Seat instability	**1**
Seat attachment failure	**automatic Poor**
Vehicle door opening	**automatic Poor**

Restraints & Kinematics ❻	Good	Acceptable	Marginal	Poor
Sum of Demerits	≤ 1	≤ 3	≤ 5	> 5

Small Overlap Overall Rating

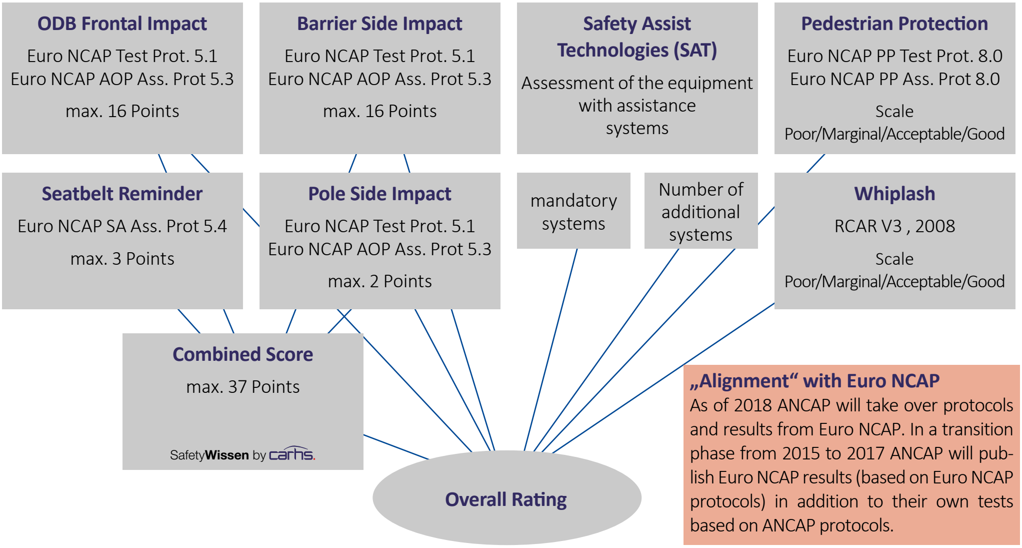
Rating system based on a demerit system. Demerits result from the injury, structure and restraints & kinematics ratings.

Component Rating	Good	Acceptable	Marginal	Poor
Vehicle Structure Rating ❶	0	2	6	10
Head/Neck Injury Rating ❷	0	2	10	20
Chest Injury Rating ❸	0	2	10	20
Thigh and Hip Injury Rating ❹	0	2	6	10
Leg and Foot Injury Rating ❺	0	1	2	4
Restraints / Kinematics Rating ❻	0	2	6	10
The overall rating depends on the sum of demerits:				SafetyWissen by carhs.
Overall Rating	Good	Acceptable	Marginal	Poor
Sum of demerits	≤ 3	≤ 9	≤ 19	> 19

Australasian NCAP (ANCAP)

Roadmap Update 23. April 2014

ANCAP was harmonized with Euro NCAP until 2009. The harmonization ended with the introduction of Euro NCAP's overall rating in 2009. ANCAP has now developed a new overall rating scheme that will be introduced in the period from 2011 -2017. As of 2018 ANCAP will re-align with Euro NCAP.



„Alignment" with Euro NCAP
As of 2018 ANCAP will take over protocols and results from Euro NCAP. In a transition phase from 2015 to 2017 ANCAP will publish Euro NCAP results (based on Euro NCAP protocols) in addition to their own tests based on ANCAP protocols.

Points required for the respective star rating	Frontal- and Barrier-Side-Impact each	Pole-Side-Impact	Combinied points	Pedestrian Protection	Whiplash	mandatory SAT						additional SAT (count)
						ESC	3PSB	HPT	SBR	EBA	TT	
★★★★★	12.5	1	32.5	Acceptable	Good	●	●	●[2]	●[1+3]	●	●	6
★★★★	8.5	1	24.5	Acceptable	Good	●	●	●[2]	●[1+3]	●	●	5
★★★	4.5	-	16.5	Acceptable	Acceptable	●	●	●[1]	●[1]	●	●	4
★★	1.5	-	8.5	Marginal	Acceptable	●	●	●[1]	●[1]		●	3
★	-	-	0.5	Marginal	Acceptable	●	●		●[1]		●	2

[1] front (1st row of seats)
[2] 2nd row of seats
[3] fixed seats in 2nd row of seats

ESC: Electronic Stability Control
SBR: Seat Belt Reminder
HPT: Head-protecting technology - side airbags

3PSB: 3-Point Seat Belts
EBA: Emergency Brake Assist
TT: Top Tether

More details, including a list of additional SAT, are available in the „ANCAP RATING ROAD MAP 2011-2017" which can be downloaded from http://www.ancap.com.au/media or can be found on **SafetyWissen.com**

Latin NCAP Rating in Adult- and Child-Occupant Protection

Adult Occupant Protection

Assessment Protocol Version 3.2

Star Rating	Required Score: Frontal ODB + Side MDB (max. 16+16=32 Pt.)[1]	Required Score: Seat Belt Reminder SBR (max. 2 Pt.)	Additional Requirements: ABS	Additional Requirements: ESC acc. GTR 8	Additional Requirements: Pole-Side Impact acc. Euro NCAP Protocol 5.2
★★★★★	≥ 27	≥ 1		✓	✓
★★★★	≥ 22	≥ 1		✓	
★★★	≥ 16	≥ 0.5	✓		
★★	≥ 10				
★	≥ 4				SafetyWissen by carhs.

[1] If the scores for frontal and side impact differ more than 35% the rating will be reduced by 1 star.

Child Occupant Protection (➲ page 88)

Assessment Protocol Version 3.1

Star Rating	Required Score (out of max. 49 points)
★★★★★	≥ 41
★★★★	≥ 35
★★★	≥ 27
★★	≥ 18
★	≥ 9

SafetyWissen by carhs.

Frontal Impact with 40 % Overlap @ 64 km/h

Dummy	Body Region	Points	Criteria	
H III 50 % front	Head, Neck	4	HIC_{15} < 500; a_{3ms} < 72 g $M_{y,extension}$ < 42 Nm $F_{z,tension}$ < 2.7 kN @ 0 ms / < 2.3 kN @ 35 ms / < 1.1 kN @ 60 ms $F_{x,shear}$ < 1.9 kN @ 0 ms / < 1.2 kN @ 25 – 35 ms / < 1.1 kN @ 45 ms	max. 16 points
		0	HIC_{15} > 700; a_{3ms} > 88 g $M_{y,extension}$ > 57 Nm $F_{z,tension}$ > 3.3 kN @ 0 ms / > 2.9 kN @ 35 ms / > 1.1 kN @ 60 ms $F_{x,shear}$ > 3.1 kN @ 0 ms / > 1.5 kN @ 25 – 35 ms / > 1.1 kN @ 45 ms	
	Chest	4	Deflection < 22 mm; VC < 0.5 m/s	
		0	Deflection > 42 mm; VC > 1.0 m/s	
	Femur, Knee	4	Axial $Force_{compr}$ < 3.8 kN; Knee Displacement < 6 mm	
		0	Axial $Force_{compr}$ > 9.07 kN @ 0 ms / > 7.56 @ 10 ms; Knee Displacement > 15 mm	
	Tibia, Foot	4	TI < 0.4, Axial $Force_{compression}$ < 2 kN; x–Displacement Pedals < 100 mm	
		0	TI > 1.3, Axial $Force_{compression}$ > 8 kN; x–Displacement Pedals > 200 mm	

Barrier Side Impact (MDB) @ 50 km/h

Dummy	Body Region	Points	Criteria	
ES-2 front	Head	4	HIC_{15} < 500; a_{3ms} < 72 g	max. 16 points
		0	HIC_{15} > 700; a_{3ms} > 88 g	
	Chest	4	Deflection < 22 mm; VC < 0.32 m/s	
		0	Deflection > 42 mm; VC > 1.0 m/s	
	Abdomen	4	$Force_{compression}$ < 1.0 kN	
		0	$Force_{compression}$ > 2.5 kN	
	Pelvis	4	PSPF < 3.0 kN	
		0	PSPF > 6.0 kN	

ASEAN NCAP

Overall Assessment Protocol Version 1.0

Overall Rating 2017

	Adult Occupant Protection		Child Occupant Protection		Safety Assist		
	Offset Frontal Impact	16	Dynamic Assessment Frontal	16	Effective Braking & Avoidance	8	
	Side Impact (MDB)	16	Dynamic Assessment Side	8	Seat Belt Reminder	6	
	Head Protection Technology	4	CRS Installation	12	Blind Spot Technology	2	
			Vehicle-based Assessment	13	Advanced SATs	2	
max. points (1)		36	➲ Page 88	49	➲ Page 110	18	
normalized score (2)	actual points / (1)		actual points / (1)		actual points / (1)		
weighting (3)	50 %		25 %		25 %		Overall score (5)
weighted score (4)	(2)x(3)		(2)x(3)		(2)x(3)		Σ(4)
Rating	Balancing: minimum normalized score (2) per box required for the respective star rating:						min. overall score (5)
	score	points	score	points	score	points	Score
★★★★★	75 %	27.00	75 %	36.75	60 %	10.80	75 %
★★★★	65 %	23.40	60 %	29.40	40 %	7.20	65 %
★★★	45 %	16.20	30 %	14.70	30 %	5.40	50 %
★★	30 %	10.80	25 %	12.25	20 %	3.60	40 %
★	20 %	7.20	15 %	7.35	10 %	1.80	30 %

AOP Assessment Protocol Version 1.0

Adult Occupant Protection

Frontal Impact with 40 % Overlap @ 64 km/h

Dummy	Region	Points	Criteria	
H III 50 % front	Head, Neck	4	$HIC_{15} < 500$; $a_{3ms} < 72$ g $M_{y,extension} < 42$ Nm $F_{z,tension} < 2.7$ kN @ 0 ms / < 2.3 kN @ 35 ms / < 1.1 kN @ 60 ms $F_{x,shear} < 1.9$ kN @ 0 ms / < 1.2 kN @ 25 – 35 ms / < 1.1 kN @ 45 ms	max. 16 points
		0	$HIC_{15} > 700$; $a_{3ms} > 88$ g $M_{y,extension} > 57$ Nm $F_{z,tension} > 3.3$ kN @ 0 ms / > 2.9 kN @ 35 ms / > 1.1 kN @ 60 ms $F_{x,shear} > 3.1$ kN @ 0 ms / > 1.5 kN @ 25 – 35 ms / > 1.1 kN @ 45 ms	
	Chest	4	Deflection < 22 mm; VC < 0.5 m/s	
		0	Deflection > 42 mm; VC > 1.0 m/s	
	Femur, Knee	4	Axial $Force_{compression} < 3.8$ kN Knee Displacement < 6 mm	
		0	Axial $Force_{compression} > 9.07$ kN @ 0 ms / > 7.56 @ 10 ms Knee Displacement > 15 mm	
	Tibia Foot	4	TI < 0.4; Axial $Force_{compression} < 2$ kN Pedal rearward displacement <100 mm	
		0	TI > 1.3; Axial $Force_{compression} > 8$ kN Pedal rearward displacement > 200 mm	

Barrier Side Impact (MDB) @ 50 km/h

Dummy	Region	Points	Criteria	
ES-2	Head	4	$HIC_{36} < 650$; $a_{3ms} < 72$ g	max. 16 points
		0	$HIC_{36} > 1000$; $a_{3ms} > 88$ g	
	Chest	4	Deflection < 22 mm; VC < 0.32 m/s	
		0	Deflection > 42 mm; VC > 1.0 m/s	
	Abdomen	4	$Force_{compression} < 1.0$ kN	
		0	$Force_{compression} > 2.5$ kN	
	Pelvis	4	PSPF < 3.0 kN	
		0	PSPF > 6.0 kN	

China NCAP

Protocol 2015 [2018]

Values in brackets []: planned changes in 2018

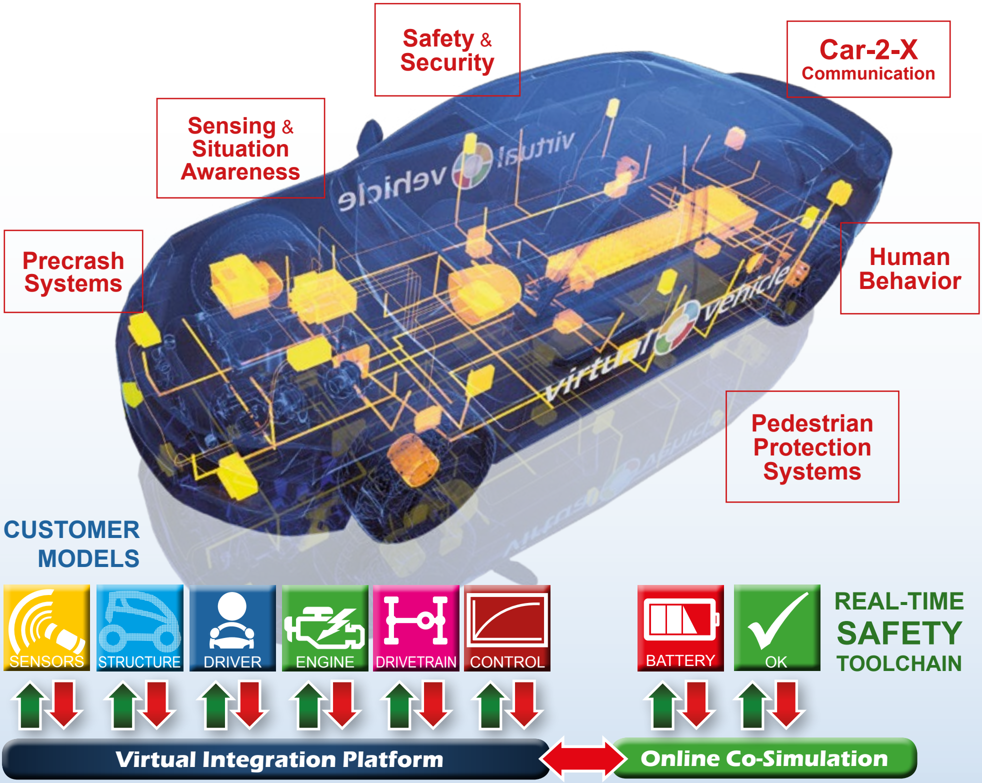
Frontal Impact with 100 % Overlap @ 50 km/h ①

Dummy	Region	Points	Criteria	
H III 50 % front	Head	5	$HIC_{36} < 650$; $a_{3ms} < 72$ g	max. 18 [20] points
		0	$HIC_{36} > 1000$; $a_{3ms} > 88$ g	
	Neck	2	$M_{y,extension} < 42$ Nm $F_{z,tension} < 2.7$ kN @ 0 ms / < 2.3 kN @ 35 ms / < 1.1 kN @ 60 ms $F_{x,shear} < 1.9$ kN @ 0 ms / < 1.2 kN @ 25 – 35 ms / < 1.1 kN @ 45 ms	
		0	$M_{y,extension} > 57$ Nm $F_{z,tension} > 3.3$ kN @ 0 ms / > 2.9 kN @ 35 ms / > 1.1 kN @ 60 ms $F_{x,shear} > 3.1$ kN @ 0 ms / > 1.5 kN @ 25 – 35 ms / > 1.1 kN @ 45 ms	
	Chest	5	Deflection < 22 mm; VC < 0.5 m/s	
		0	Deflection > 50 mm; VC > 1.0 m/s	
	Femur Knee	2	Axial $Force_{compression} < 3.8$ kN; Knee Displacement < 6 mm	
		0	Axial $Force_{compression} > 9.07$ kN @ 0 ms / > 7.56 @ 10 ms; Knee Displacement > 15 mm	
	Tibia	2	TI < 0,4; Axial $Force_{compression} < 2$ kN	
		0	TI > 1,3; Axial $Force_{compression} > 8$ kN	
H III 5 % rear	Head	0.8 [1.6]	$HIC_{15} < 500$	
		0	$HIC_{15} > 700$	
	Neck	0.2 [0.4]	$F_{x,shear} < 1200$ N; $F_{z,tension} < 1700$ N; $M_{y,extension} < 36$ Nm	
		0	$F_{x,shear} > 1950$ N; $F_{z,tension} > 2620$ N; $M_{y,extension} > 49$ Nm	
	Chest	1 [2]	Deflection < 23 mm	
		0	Deflection > 48 mm	

Frontal Impact with 40 % Overlap @ 64 km/h ②

Dummy	Region	Points	Criteria	
H III 50 % front	Head, Neck	4	$HIC_{36} < 650$, $a_{3ms} < 72$ g $M_{y,extension} < 42$ Nm $F_{z,tension} < 2.7$ kN @ 0 ms / < 2.3 kN @ 35 ms / < 1.1 kN @ 60 ms $F_{x,shear} < 1.9$ kN @ 0 ms / < 1.2 kN @ 25 – 35 ms / < 1.1 kN @ 45 ms	max. 18 [20] points
		0	$HIC_{36} > 1000$, $a_{3ms} > 88$ g $M_{y,extension} > 57$ Nm $F_{z,tension} > 3.3$ kN @ 0 ms / > 2.9 kN @ 35 ms / > 1.1 kN @ 60 ms $F_{x,shear} > 3.1$ kN @ 0 ms / > 1.5 kN @ 25 – 35 ms / > 1.1 kN @ 45 ms	
	Chest	4	Deflection < 22 mm; VC < 0.5 m/s	
		0	Deflection > 50 mm; VC < 1.0 m/s	
	Femur Knee	4	Axial $Force_{compression} < 3.8$ kN, Knee Displacement < 6 mm	
		0	Axial $Force_{compression} > 9.07$ kN @ 0 ms / > 7.56 @ 10 ms, Knee Displacement > 15 mm	
	Tibia	4	TI < 0.4; Axial $Force_{compression} < 2$ kN	
		0	TI > 1.3; Axial $Force_{compression} > 8$ kN	
H III 5 % rear	Head, Neck	1 [2]	$HIC_{15} < 500$, $F_{x,shear} < 1200$ N, $F_{z,tension} < 1700$ N, $M_{y,extension} < 36$ Nm	
		0	$HIC_{15} > 700$, $F_{x,shear} > 1950$ N, $F_{z,tension} > 2620$ N, $M_{y,extension} > 49$ Nm	
	Chest	1 [2]	Deflection < 23 mm	
		0	Deflection > 48 mm	

Verification and Validation of ADAS and Safety Systems



Validation of ADAS and Automated Drive Systems

Integrated Safety System Assessment

Human Systems Integration

Virtual - Hybrid - Real Testing

www.v2c2.at

virtual vehicle

Dr. Andreas Rieser
Technical Head Integrated Safety
andreas.rieser @ v2c2.at

VIRTUAL VEHICLE - Kompetenzzentrum
Das virtuelle Fahrzeug Forschungs-GmbH
Inffeldgasse 21A, 8010 Graz, AUSTRIA

Tel.: +43-316-873-9001
E-Mail: safety @ v2c2.at
Web: www.v2c2.at

China NCAP

Protocol 2015 [2018]

Values in brackets []: planned changes in 2018

Barrier Side Impact ([AE]MDB) @ 50 km/h ❸

Dummy	Region	Points	Criteria	
ES-2 front [WS 50]	Head	4	HIC_{36} < 650 [HIC_{15} < 500]; a_{3ms} < 72 g	max. 18 [20] points
		0	HIC_{36} > 1000 [HIC_{15} > 700]; a_{3ms} > 88 [80]g	
	Chest	4	Deflection < 22[28] mm; VC < 0.32[-] m/s	
		0	Deflection > 42 [50] mm; VC > 1.0 m/s; [Shoulder Lateral Force > 3.0 kN]	
	Abdomen	4	Axial $Force_{compression}$ < 1.0 kN; [Deflection <47 mm]	
		0	Axial $Force_{compression}$ > 2.5 kN; [Deflection > 65 mm; VC > 1.0 m/s]]	
	Pelvis	4	PSPF < 3.0 [1.7] kN	
		0	PSPF > 6.0 [2.8] kN	
SID-IIs rear	Head	1	HIC_{15} < 500	
		0	HIC_{15} > 700	
	[Chest]	[1]	[Deflection < 31 mm]	
		0	[Deflection > 41 mm; VC > 1.0 m/s]	
	[Abdomen]	[1]	[Deflection < 38 mm]	
		0	[Deflection > 48 mm; VC > 1.0 m/s]	
	Pelvis	1	Force < 3500 N	
		0	Force > 5500 N	

Whiplash Test @ v = 15.65 [20.00] km/h ❹

Dummy	Region	Points	Criteria	
BioRID II	NIC	2	< 8 m^2/s^2	max. 4 [5] points
		0	> 30 m^2/s^2	
	Upper Neck	1 [1.5]	F_{x+}<340 N, F_{z+}< 475 N, M_y < 12 Nm	
		0	F_{x+}> 730 N, F_{z+}> 1130 N, M_y > 40 Nm	
	Lower Neck	1 [1.5]	F_{x+}<340 N, F_{z+}< 257 N, M_y < 12 Nm	
		0	F_{x+}> 730 N, F_{z+}> 1480 N, M_y > 40 Nm	
	max. dyn. seatback defl.	-2	> 19° [25.5°]	
	dyn. seat displacement	-4[-5]	> 20 mm	
	HRMD interference	-2	Y/N	

Additional Points ❺

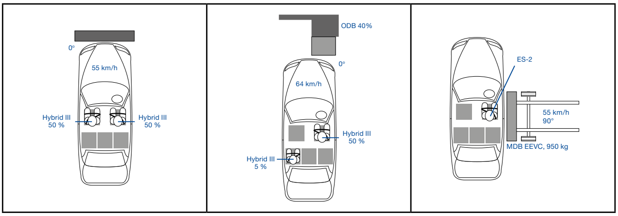
Region	Points	Criteria	
SBR Passenger	1	Visual / Audio Signal with occupant detection	max. 3 [5] pt.
	0.5	Visual / Audio Signal without occupant detection	
[SBR 2nd row]	1	[Status indicator for each 2nd row seat]	
Side Protection	1 [3]	Side / Curtain-Airbag	
ESC	1 [-[1]]	acc. GTR 8 or FMVSS 126 or UN R13H (R140) ➲ page 114	

Overall Rating

Overall Rating	2017	2018 (Weighting: Occupant Protection 70 %, Pedestrian Protection + Active Safety 15 % each)			
Stars	Total Points ❶+❷+❸+❹+❺	Total score	Balancing: Occupant Prot.	Balancing: Pedestrian Prot.	Balancing: Active Safety
★★★★★☆	≥ 60	90 %	95 %	75 %	50/55[2]/72[3] %
★★★★★	≥ 54 ... < 60	82 %	85 %	65 %	26/38[2]/55[3] %
★★★★	≥ 48 ... < 54	72 %	75 %	50 %	26/26[2]/26[3] %
★★★	≥ 36 ... < 48	60 %	65 %	40 %	
★★	≥ 24 ... < 36	45 %	55 %	20 %	
★	< 24	< 45 %	< 55 %	< 20 %	

[1] As of 2018 ESC will be rated as part of the active safety category. [2] as of 2019 [3] as of 2020

JNCAP



Frontal Impact

Dummy	Region	Weight	Points	Criteria	
H III 50 % front	Head	0.923	4	$HIC_{36} < 650$	max. 12 points (after weighting)
			0	$HIC_{36} > 1000$	
	Neck	0.231	4	$M_{y,extension} < 42$ Nm $F_{z,tension} < 2.7$ kN @ 0 ms / < 2.3 kN @ 35 ms / < 1.1 kN @ 60 ms $F_{x,shear} < 1.9$ kN @ 0 ms / < 1.2 kN @ 25 – 35 ms / < 1.1 kN @ 45 ms	
			0	$M_{y,extension} > 57$ Nm $F_{z,tension} > 3.3$ kN @ 0 ms / > 2.9 kN @ 35 ms / > 1.1 kN @ 60 ms $F_{x,shear} > 3.1$ kN @ 0 ms / > 1.5 kN @ 25 – 35 ms / > 1.1 kN @ 45 ms	
	Chest	0.923	4	Deflection < 22 mm	
			0	Deflection > 42 mm; $a_{3ms} > 60$ g	
	Femur	0.923	2	Axial $Force_{compression} < 7$ kN	
			0	Axial $Force_{compression} > 10$ kN	
	Tibia	0.923	2	TI < 0.4	
			0	TI > 1.3	
H III 5 % rear	Head	0.8	4	$HIC_{15} < 500$	max. 12 points (after weighting)
			0	$HIC_{15} > 700$	
	Neck	0.2	4	$F_{x,shear} < 1200$ N; $F_{z,tension} < 1700$ N; $M_{y,extension} < 36$ Nm	
			0	$F_{x,shear} > 1950$ N; $F_{z,tension} > 2620$ N; $M_{y,extension} > 49$ Nm	
	Chest	0.8	4	Deflection < 23 mm	
			0	Deflection > 48 mm	
	Abdomen	0.8	4	4 points awarded by default	
	Femur	0.4	4	Axial $Force_{compression} < 4.8$ kN	
			0	Axial $Force_{compression} > 6.8$ kN	

Rating Scheme Frontal & Side Impact, Whiplash:

Level	Required Points
5	≥ 10.5
4	≥ 9
3	≥ 7.5
2	≥ 6
1	< 6

SafetyWissen by carhs.

Side Impact

Dummy	Region	Weight	Points	Criteria	
ES-2 front	Head	1.0	4	$HIC_{36} < 650$	max. 12 pt. (after weighting)
			0	$HIC_{36} > 1000$	
	Chest	1.0	4	Deflection < 22 mm	
			0	Deflection > 42 mm	
	Abdomen	0.5	4	$Force_{compression} < 1.0$ kN	
			0	$Force_{compression} > 2.5$ kN	
	Pelvis	0.5	4	PSPF < 3.0 kN	
			0	PSPF > 6.0 kN	

SafetyWissen by carhs.

JNCAP

Dummy	Criteria		Weight	Points	Limits	
Whiplash Test						
BioRID II	NIC		1	4	< 8 m²/s²	max. 12 points (after weighting)
				0	> 30 m²/s²	
	Upper Neck F_{x+}	score is calculated based on the worst injury criterion	2	4	< 340 N	
				0	> 730 N	
	Upper Neck F_{z+}			4	< 475 N	
				0	> 1130 N	
	Upper Neck M_y Flexion			4	< 12 Nm	
				0	> 40 Nm	
	Upper Neck M_y Extension			4	< 12 Nm	
				0	> 40 Nm	
	Lower Neck F_{x+}			4	< 340 N	
				0	> 730 N	
	Lower Neck F_{z+}			4	< 257 N	
				0	> 1480 N	
	Lower Neck M_y Flexion			4	< 12 Nm	
				0	> 40 Nm	
	Lower Neck M_y Extension			4	< 12 Nm	
				0	> 40 Nm	

Where a value falls between the upper and lower limit, the score is calculated by linear interpolation (sliding scale).

Overall Rating

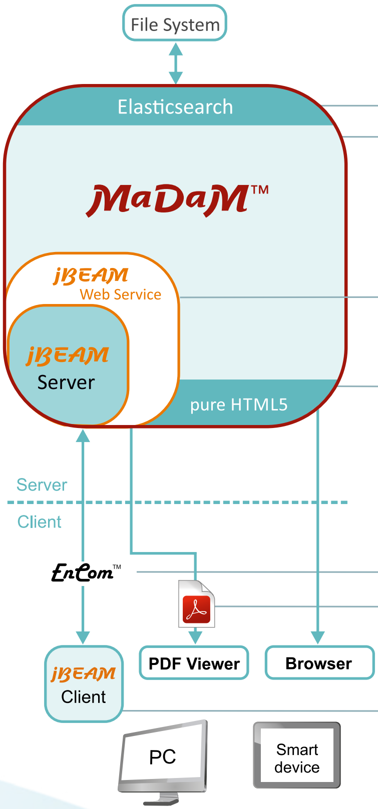
	max. score	weight	max. weighted score	total	total
Occupant Protection					208 ★★★★★ ≥ 170[2] ★★★★ ≥ 150 ★★★ ≥ 130 ★★ ≥ 110 ★ < 110
Full-width Frontal				100	
Driver	12	1.250	15		
Passenger	12	1.250	15		
Offset Frontal					
Driver	12	1.250	15		
Passenger (rear)	12	1.250	15		
Side Impact					
Driver	12	1.042	12.5		
Passenger[1]	12	1.042	12.5		
Whiplash					
Driver	12	0.625	7.5		
Passenger	12	0.625	7.5		
Pedestrian Protection (➲ page 80)					
Head Impact	4	20	80	100	
Leg Impact	4	5	20		
Seat Belt Reminder					
Front	50	0.08	4	8	
Rear	50	0.08	4		SafetyWissen by carhs.

[1] For the passenger the same score as for the driver is assumed.
[2] Downgrade to 4 stars, unless at least level 4 is reached for occupant protection and pedestrian head impact and level 3 is reached in pedestrian leg impact.

Measurement Data Management

MaDaM™ - the Genuine Web Solution by AMS

Unlimited Crash-Data-Management and Analysis



Elasticsearch Indexing Technology
- No need for a relational database

MaDaM™
- Import of test data (MDF, ATFX, ...)
- Search & find of tests
- Preview of selected test data
- Reporting & interactive analysis

jBEAM™ Server
- NCAP Crash Analysis
- Reporting with predefined templates

pure HTML5 user-interface
- Highly interactive search
- Flexible & intuitive queries
- Queries for measurement values
- PCs and smart devices

EnCom™
- Enterprise Communication Protocol
- Minimizes network traffic

PDF - Standard Report

jBEAM™ Client
- Interactive data postprocessing

- **Big data support**
- **Full video support**
- **NCAP crash analysis**

Reference installation: SAIC, IAV, Daimler

Example: MaDaM™ running NCAP crash analysis

AMS

Germany, Chemnitz
info@AMSonline.de

P.R. China, Shanghai
info@AMSonline.cn

USA, Auburn Hills
info@AMSonline.eu

KNCAP

Protocol 2017

Category	Impact Safety		Pedestrian Safety		Driving Safety		
	Full Width Frontal	16	Head Impact	24	Rollover	5	
	Offset Deformable Barrier	16	Leg Impact	6	Braking	5	
	Barrier Side Impact	16			*Basic Active Devices:*		
	Child Protection	8			FCWS	0.5	
	Whiplash	4			LDWS	0.5	
	Pole Side Impact (optional [1])	(2)			SLD	0.5	
					SBR front	0.5	
					SBR rear	0.5	
					AEB Inter-Urban	1	
					AEB City	1.5	
max. total points (1)	60 points		30 points		15 points		
normalized score (2)	actual points / (1)		actual points / (1)		actual points / (1)		
weighting (3)	60 %		25 %		15 %		
weighted score (4)	(2) x (3)		(2) x (3)		(2) x (3)		Overall score (6)
additional scores (5)	*Additional Active Devices: (optional [1]):* ASCC (0.5); BSD (0.5); RCTA (0.5); LKAS (0.5); ISA (0.5); AEB Pedstrian (1); Advanced Airbag (1) - *Max. total points for Additional Active Devices = 2*						Σ (4)+(5) *max. 100*

Overall classification: Minimum normalized scores (2) and total score (6) per rating class

	Impact Safety	Pedestrian Safety	Driving Safety	Overall score (6)
1st Grade	≥ 90.1 %	≥ 60.1 %	-	≥ 86.1 %
2nd Grade	≥ 83.1 %	≥ 50.1 %	-	≥ 81.1 %
3rd Grade	≥ 76.1 %	≥ 40.1 %	-	≥ 76.1 %
4th Grade	≥ 69.1 %	≥ 35.1 %	-	≥ 71.1 %
5th Grade	≤ 69.0 %	≤ 35.0 %	-	≤ 71.0 %

Star rating per category: Minimum normalized scores (2) for the respective star rating

Category	Impact Safety	Pedestrian Safety	Driving Safety
★★★★★	≥ 93.1 %	≥ 83.1 %	≥ 84.8 %
★★★★	≥ 90.1 %	≥ 63.1 %	≥ 70.5 %
★★★	≥ 87.1 %	≥ 43.1 %	≥ 55.4 %
★★	≥ 84.1 %	≥ 23.1 %	≥ 40.3 %
★	≤ 84.0 %	≤ 23.0 %	≤ 40.2 %

[1] Optional items can be assessed upon the manufacturers request. The maximum total points remains the same.

KNCAP

Protocol 2017

Frontal Impact with 40 % Overlap @ 64 km/h

Dummy	Region	Points	Criteria	
H III 50 %	Head, Neck	4	HIC_{36} < 650; $M_{y,extension}$ < 42 Nm; $F_{z,tension}$ < 2.7 kN; $F_{x,shear}$ < 1.9 kN	max. 16 points
		0	HIC_{36} > 1000; $M_{y,extension}$ > 57 Nm; $F_{z,tension}$ > 3.3 kN; $F_{x,shear}$ > 3.1 kN	
	Chest	4	Deflection < 22 mm; VC < 0.5 m/s	
		0	Deflection > 50 mm; VC > 1.0 m/s	
	Femur Knee	4	Axial $Force_{compr}$ < 3.8 kN; Knee displacement < 6 mm	
		0	Axial $Force_{compr}$ > 9.07 kN; Knee displacement > 15 mm	
	Tibia	4	TI < 0.4; Axial $Force_{compr}$ < 2 kN	
		0	TI > 1.3; Axial $Force_{compr}$ > 8 kN	
Modifiers		0...-1	steering wheel upward displacement 72...88 mm (from head score)	
		0...-1	steering wheel rearward displacement 90...110 mm (from head score)	
		0...-1	A-pillar rearward displacement 100...200 mm (from chest score)	
		-1	door latch or hinge failure (from chest score)	
		0...-1	pedal upward displacement 72...88 mm (from tibia score)	
		0...-1	pedal rearward displacement 100...200 mm (from tibia score)	
		-1	door opening during impact	
		-1	fuel leakage	

Frontal Impact with 100 % Overlap @ 56 km/h

Dummy	Region	Points	Criteria	
H III 5 %	Head, Neck	6	HIC_{15} < 500, $F_{x,shear}$ < 1.2 kN, $F_{z,tension}$ < 1.7 kN, $M_{y,extension}$ < 36 Nm	max. 16 points
		0	HIC_{15} > 700, $F_{x,shear}$ > 1.95 kN, $F_{z,tension}$ > 2.62 kN, $M_{y,extension}$ > 49 Nm	
	Chest	6	Deflection < 22 mm	
		0	Deflection > 48 mm	
	Femur	4	Axial $Force_{compr}$ < 3.8 kN	
		0	Axial $Force_{compr}$ > 6.8 kN	
Modifiers		-1	door opening during impact	
		-1	fuel leakage	

Barrier Side Impact (MDB) @ 55 km/h

Dummy	Region	Points	Criteria	
WS 50%	Head	4	HIC_{15} < 500; a_{3ms} < 72 g	max. 16 points
		0	HIC_{15} > 700; a_{3ms} > 80 g	
	Chest	4	Deflection < 28 mm;	
		0	Deflection > 50 mm; VC ≥ 1.0 m/s; Shoulder $Force_{Lateral}$ ≥ 3.0 kN	
	Abdomen	4	Deflection < 47 mm;	
		0	Deflection > 65 mm; VC ≥ 1.0 m/s	
	Pelvis	4	PSPF < 1.7 kN	
		0	PSPF > 2.8 kN	
Modifiers		-1	door opening during impact	

Pole Side Impact @ 32 km/h

Dummy	Region	Points	Criteria	
WS 50%	Head	2	HIC_{15} < 500	2
		0	HIC_{15} > 700	

Whiplash Test

Dummy	Dynamic Assessment	1.5 Points	0 Points		
BioRID IIg	NIC	11.00	24.00	max. 9 points	max. 10 points (scaled to 4)
	Nkm	0.15	0.55		
	Rebound velocity (m/s)	3.2	4.8		
	Upper Neck $F_{x,shear}$ (N)	30	190		
	Upper Neck $F_{z,tension}$ (N)	360	750		
	T1 acceleration* (g)	9.30	13.10		
	T-HRC* (ms)	57	82		
	Geometry Assessment	1 Point	-1 Point		
HRMD	Backset (mm)	40	100	max. 1 pt	
	Height (mm)	0	80		

* Only the maximum score from either T1 acceleration or head restraint contact time is used in the rating.

BNVSAP Bharat New Vehicle Safety Assessment Program (India)

Time schedule

- Phase I
  - starting October 2016: Manufacturers can have their vehicles assessed on a voluntary basis
  - starting October 2017: BNVSAP selects vehicles to be assessed
- Phase II starting October 2020: Extension of the tests: ODB 64 km/h, FW 50 km/h, Rear Impact 35 km/h, Whiplash
- Phase III starting October 2022: adapatation of the rating based on accident data

Phase I Assessment scheme

Category	Test / Requirement	Max. points available for meeting relevant legal (AIS) requirements	Max. points available for meet-ing BNVSAP criteria	Max. total points
Adult Occupant Protection	ODB Frontal Test 40 % / 56 km/h (AIS 098 / UN R94)	4	12	16
	MDB Side Test 50 km/h (AIS 099 / UN R95)	4	4	8
Child Occupant Protection	Dynamic Assessment in ODB Frontal Test	-	4	4
Pedestrian Protection	Head Impact (AIS 100)	4	-	4
Other Requirements	Rear Impact (AIS 101 / UN R34)	-	2	max. 8
	Type approved ABS System		2	
	Seat Belt Reminder (SBR) Driver 1 point, Passenger 1 point		2	
	Validated Electronic Stability Control (ESC)		1	
	Validated Electronic Brake Distribution (EBD)		1	
	Type approved head restraint system (for all forward facing outboard seats)		1	
	Child lock functionality check		1	
Total max.				40

	Overall Rating		Adult Occupant Protection	
Rating	required points (out of max. 40)	% of max	required points (out of max. 24)	% of max
★★★★★	34	85	21	87.5
★★★★	28	70	17	70.8
★★★	22	55	12	50
★★	16	40	8	20
★	12	30	4	10

Note: BNVSAP is still in its introduction phase. Therefore modifications may still occur.

Product Liability in the Automobile Industry

Course Description

In the framework of the ongoing extension of active and passive safety systems automobiles are becoming increasingly complex.
In this context the faultlessness of systems becomes more and more important, as with growing complexity not only the number but also the severity of possible faults is increasing. An indicator for this is the growing number of recalls in recent years.
Each manufacturer holds the responsibility for consequential damages caused by its products when used as intended. This responsibility is defined by law in all countries and has civil and criminal penalties.
Examples include the recalls of large numbers of vehicles that several OEMs were obliged to do during the last few years.

Obviously a safety related recall of a mass product may have severe or even existence-threatening consequences.

Consequently, manufacturers must ensure faultlessness throughout their organization.

Course Objectives

The aim of this course is to convey the importance of product liability for businesses and employees as well as an understanding of preventive measures.

Note: Product liabilty is not limited to passive safety. Therefore this course is also suitable for developers of active safety systems and driver assistance systems.

Who should attend?

The seminar is aimed at all decision-makers in the automotive development, who want to learn about the consequences of product liability and want to learn about preventive measures.

Course Contents

- Fundamentals of Product Liability
- Civil and criminal responsibility of the company and personal liability of employees
- Liability for Defects
- Product liability in Europe and in the U.S.
- U.S. TREAD ACT, Reporting obligation for OEMs and suppliers
- Product liability and advertisement and public relations of companies
- Quality management and its relevance from a product liability point of view
- Product liability in the supply chain
- Instructions, warnings
- Risk minimization within the organization, prevention
- Documentation, conclusive evidence
- Insurance of product liability risk
- Recall decision and processing

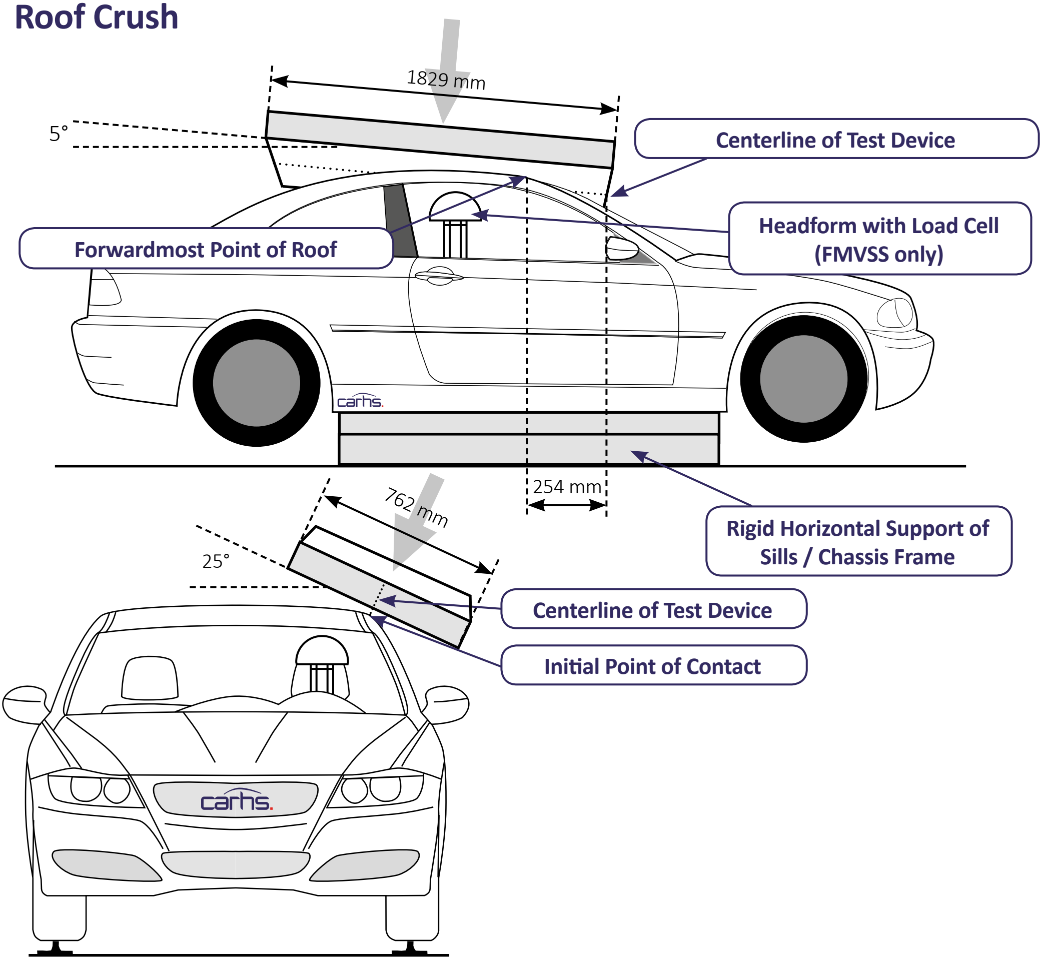
Instructor

Hans-Georg Lohrmann was Manager of Reliability & Conformity of Production at ZF TRW Automotive GmbH. He has many years of experience in the field of safety, reliability and product liability in the automotive sector. Since September 2015 he has retired and is still active as a freelance consultant. He specializes in the area of restraint systems for vehicle occupant protection and supports his clients in the areas of reliability, safety planning and methods of verification, application and development of a product conformity certificate system and litigation support.

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
06.-07.02.2017	2911	Alzenau	2 Days	1.290,- EUR till 09.01.2017, thereafter 1.540,- EUR	German
23.-24.05.2017	2913	Alzenau	2 Days	1.290,- EUR till 25.04.2017, thereafter 1.540,- EUR	English
16.-17.10.2017	2912	Alzenau	2 Days	1.290,- EUR till 18.09.2017, thereafter 1.540,- EUR	German

Roof Crush



IIHS

Testing Protocol Version III (July 2016)

Platen Displacement: 127 mm

Feed Rate: 5 mm/s

Single Side Test: Lab selects worst case

Assessment:
based on Strength-to-weight ratio (SWR) = F_{max} / m x g

SWR	Rating
≥ 4.00	Good
≥ 3.25 till <4.00	Acceptable
≥ 2.50 till <3.25	Marginal
< 2.50	Poor

A „Good“ rating in the roof crush test is a requirement for the Top-SafetyPick award.

SafetyWissen by carhs.

FMVSS 216a

Docket No. NHTSA-2009-0093

Application:
Vehicles with a GVWR ≤ 4536 kg

Applied Force:
for vehicles with a GVWR ≤ 2722 kg:
F = 3.0 x GVWR x 9.8 m/s^2
for vehicles with a GVWR > 2722 kg:
F = 1.5 x GVWR x 9.8 m/s^2

Feed Rate: ≤ 13 mm/s

Double Sided Test

Requirements:
Platen displacement ≤ 127 mm
Load on headform located at head position of 50 % male ≤ 222 N

SafetyWissen by carhs.

Crashworthy Car Body Design - Design, Simulation, Optimization

Course Description

In the development of a car body different - sometimes conflicting - design requirements have to be met. Fulfilling crash regulations is a key task. Therefore it is mandatory that designers have a good understanding of the crash behavior of mechanical structures. The combination of knowledge about mechanics and the ability to use modern design tools allows for an efficient development process without unnecessary design iterations. The objective of the seminar is to present new methods for crashworthy car body design.

At the beginning of the course the mechanical phenomena of crash events will be discussed. Subsequently modern development methods (CAD design and crash simulation) will be treated. Thereafter modern implementations of safety design measures will be presented. Mathematical optimization of structural design - which is increasingly used in industry - will be covered at the end of the course.

Who should attend?

This 2 day course addresses designers, test and simulation engineers as well as project leaders and managers working in car body development and analysis.

Course Contents

- Mechanics of crash events
  - Accelerations during collisions
  - Structural loading during collisions
  - Examination of real crash events
  - Stability problems
  - Plasticity
- Design methods
  - Functional based design
  - Car body design
  - CAE conform design
- Crash simulation
  - Finite Element modelling of a car body
  - Finite Element analysis with explicit methods
  - Possibilities and limitations
- Technical implementation of safety measures
  - Energy absorbing members
  - Car bodies
  - Safety systems
  - Pedestrian protection
  - Post crash
- Use of mathematical optimization procedures in real world applications
  - Approximation techniques
  - Optimization software & strategies
  - Shape and topology optimization

Instructor

Prof. Dr.-Ing. Axel Schumacher (University of Wuppertal) studied mechanical engineering at the universities of Duisburg and Aachen. He received his doctorate on structural optimization from the university of Siegen. Following research projects for Airbus were focused on the optimization of aircraft structures. Thereafter he worked in the CAE methods development department of Adam Opel AG as project leader for structural optimization. From 2003 - 2012 he was a professor at the University of Applied Sciences in Hamburg and taught structural design, passive safety and structural optimization. Since 2012 he has been professor at the University of Wuppertal, where he holds the chair for optimization of mechanical structures.

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
16.-17.03.2017	2919	Alzenau	2 Days	1.290,- EUR till 16.02.2017, thereafter 1.540,- EUR	German
29.-30.05.2017	2920	Alzenau	2 Days	1.290,- EUR till 01.05.2017, thereafter 1.540,- EUR	English
11.-12.09.2017	2937	Tappenbeck	2 Days	1.290,- EUR till 14.08.2017, thereafter 1.540,- EUR	German

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DTC Dynamic Test Center AG
Route principale 127
CH-2537 Vauffelin
www.dtc-ag.ch
Phone: +41 32 321 66 00

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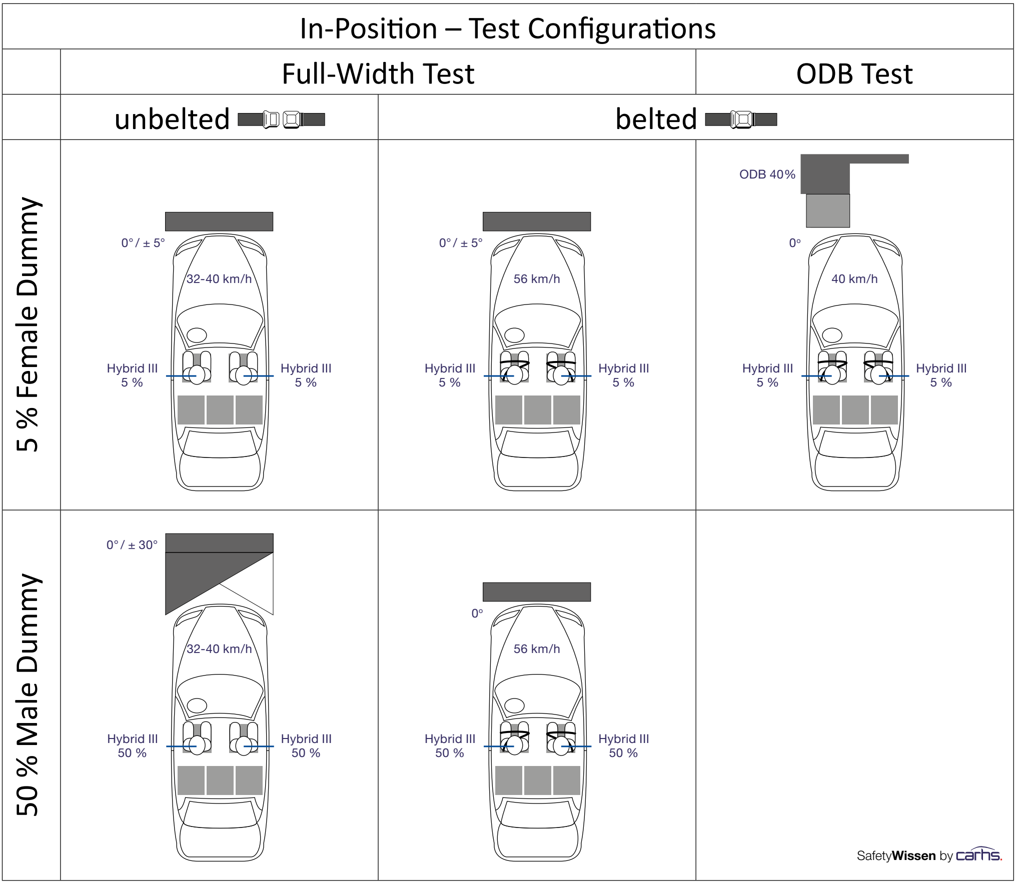
FMVSS 208: Frontal Impact Requirements: In-Position



FMVSS 208: Frontal Impact Requirements: Out of Position

Front seat	Dummy	Test configuration
Driver side	Hybrid III 5 % female	chin on airbag module in steering wheel chin on top of steering wheel
Passenger side	CRABI 12m	in 23 defined CRS / positions
	Hybrid III 3 y/o	chest on instrument panel head on instrument panel
	Hybrid III 6 y/o	chest on instrument panel head on instrument panel

Development of Frontal Restraint Systems meeting Legal and Consumer Protection Requirements

Course Description

Belts, belt-load limiters, airbags, steering column, knee bolster, seat... - only if all the components of a frontal restraint system are in perfect harmony it is possible to meet the different legal limit values as well as the requirements of consumer tests. However, these requirements, e.g. FMVSS 208, U.S. NCAP, Euro NCAP et al. are manifold and extensive, partly contradict each other, or the requirements superpose each other. Therefore it is a challenge for every development engineer to develop a restraint system by a clear, strategic procedure; time-saving and target-oriented with an optimal result.
In this 2-day seminar this strategic way of development will be shown. You will learn a procedure how to ideally solve the complex development task of a typical frontal restraint-system design within the scope of the available tools test and simulation. Especially the importance and the influence of individual system components (e.g. belt-load limiters) for the accomplishment of development-sub tasks (e.g. minimum chest deflection) will be covered. In addition the influence of the airbag module design on the hazards of Out-of-Position (OoP) situations is going to be discussed, and a possible development-path for the compliance with the OoP requirements according to the FMVSS 208 legislation will be shown. The possibilities and limits of the development tools test and simulation will be discussed and communicated. Last but not least tips and tricks for a successful overall system design will be part of this seminar.

In this seminar you will become familiar with a procedure for the successful development of a frontal restraint system. Furthermore you will learn which development tool, simulation or test, is best suited for the respective sub task. Moreover you will be made aware of the influence of the individual components of a restraint system (belts, belt-load limiters, airbags, steering column, knee bolster, seat,...) on the efficiency of the entire system.
Finally future topics such as the compatibility of vehicles as well as pre-crash preparation and prevention of accidents are integrated into the seminar.

Who should attend?

The seminar addresses simulation and test engineers, project engineers and project managers as well as the heads of development departments in the field of passive safety who work on the design of restraint-systems for vehicles.

Course Contents

- Identification of the relevant development load cases
- Procedures for the development of a restraint system
- Influence and importance of individual system components on the overall performance
- Development strategy for UN regulations and NAR restraint systems
- Development path for the conformance to the OoP requirements according to FMVSS 208

Instructor

Kai Golowko (Bertrandt Ingenieurbüro GmbH) has been working in the area of vehicle safety since 1999. He started his career as a test engineer for passive safety at ACTS. Since 2003 he has been working as senior engineer for occupant safety and pedestrian protection. Since 2005 he has managed the department vehicle safety at Bertrandt in Gaimersheim. In this position he is responsible for component development and validation and integrated safety.

Dates & Venues

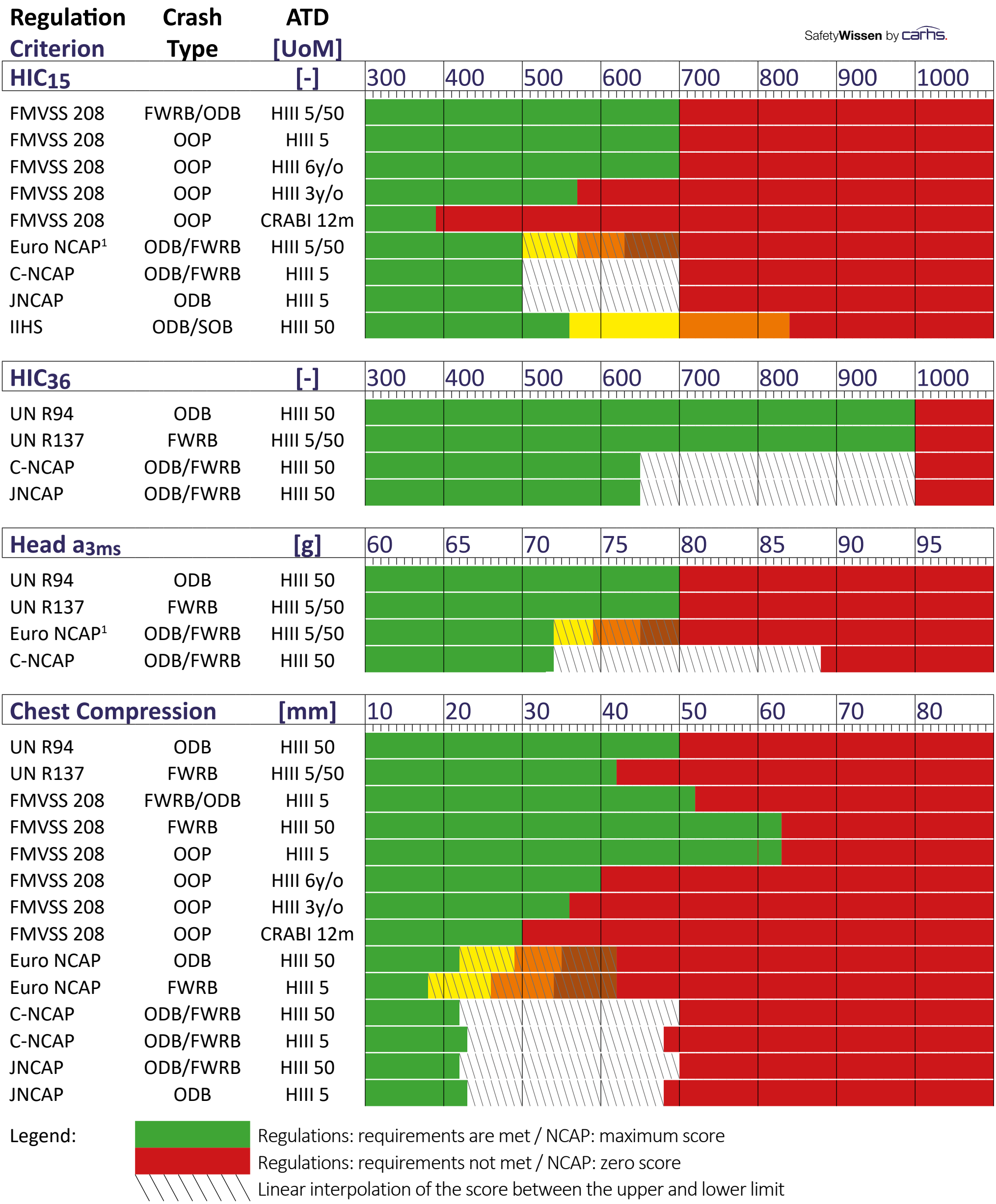
DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
15.-16.02.2017	2939	Gaimersheim	2 Days	1.290,- EUR till 18.01.2017, thereafter 1.540,- EUR	
10.-11.07.2017	2901	Alzenau	2 Days	1.290,- EUR till 12.06.2017, thereafter 1.540,- EUR	
15.-16.11.2017	2940	Tappenbeck	2 Days	1.290,- EUR till 18.10.2017, thereafter 1.540,- EUR	

Protection Criteria for Frontal Impact Tests

Configuration	Criterion	Rigid Barrier In-Position					Deformable Barrier In-Position		Out of Position			
Requirements		CMVSS 208 (old), ADR 69/00, FMVSS 208 (old)	FMVSS 208 CMVSS 208		UN R137		UN R94, ADR 73/00, FMVSS 208 (old)	FMVSS 208 CMVSS 208	FMVSS 208 CMVSS 208			
Dummy		Hybrid III	Hybrid III	Hybrid III	Hybrid III	Hybrid III	Hybrid III	Hybrid III	Hybrid III	Hybrid III	Hybrid III	CRABI
Size		50 % male	50 % male	5 % female	50 % male	5 % female	50 % male	5 % female	5 % female	6 year	3 year	1 year
Head	HIC_{36} / HPC_{36} [-]	1000 (FMVSS. ADR)			1000	1000	1000					
	HIC_{15} [-]	700 (CMVSS)	700	700				700	700	700	570	390
	a_{3ms} [g]				80	80	80					
Neck	N_{ij} [-] (4 Values)		1.0	1.0				1.0	1.0	1.0	1.0	1.0
	$F_{x,shear}$ [kN]				3.1	2.7	3.1 @ 0 ms 1.5 @ 25-35 ms 1.1 @ ≥ 45 ms					
	$F_{z,tension}$ [kN]		4.17	2.62	3.3	2.9	3.3 @ 0 ms 2.9 @ 35 ms 1.1 @ ≥ 60 ms	2.62	2.07	1.49	1.13	0.78
	$F_{z,compr.}$ [kN]		4.0	2.52				2.52	2.52	1.82	1.38	0.96
	M_y [Nm]				57	57	57					
Chest	a_{3ms} [g]	60	60	60				60	60	60	55	50
	Deflection [mm]	76.2 (FMVSS. ADR) 50 (CMVSS)	63	52	42	42 [34][1]	50 [42][3]	52	52	40	34	30[2]
	VC [m/s]				1.0	1.0	1.0					
Femur	Axial Force [kN]	10	10	6.805	9.07	7	9.07 @ 0 ms 7.58 @ > 10 ms	6.805	6.8			
Knee	Displacement [mm]						15					
Tibia	TI [-]						1.3 (4 Values)					
	Axial $Force_{compr.}$ [kN]						8.0					

[1] planned tightening of requirements as of 2020
[2] currently no measurement possible
[3] as from 1 September 2018

Frontal Impact Protection Criteria Compared

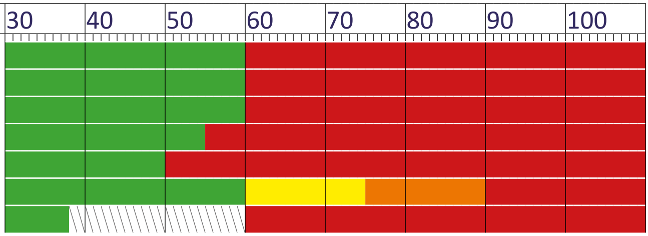


[1] assessed only if Head $a_{res\ peak}$ > 80 g

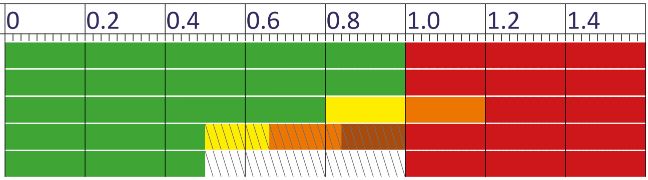
Please note that the values indicated in this graph may be rounded and that additional criteria may exist. Please take exact values and additional criteria from the tables for the respective regulation.

SafetyWissen by carhs.

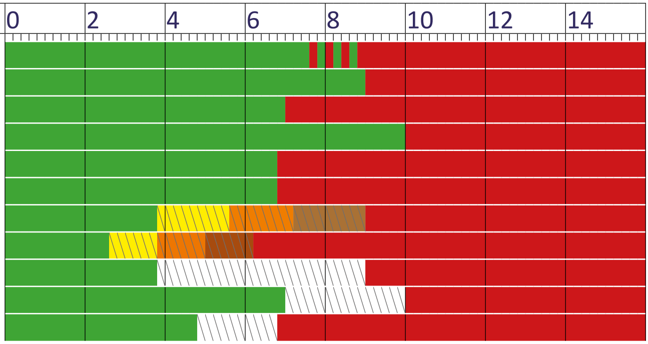
Regulation Criterion	Crash Type	ATD [UoM]
Chest a3ms		**[g]**
FMVSS 208	FWRB/ODB	HIII 5/50
FMVSS 208	OOP	HIII 5
FMVSS 208	OOP	HIII 6y/o
FMVSS 208	OOP	HIII 3y/o
FMVSS 208	OOP	CRABI 12m
IIHS	ODB/SOB	HIII 50
JNCAP	ODB/FWRB	HIII 50



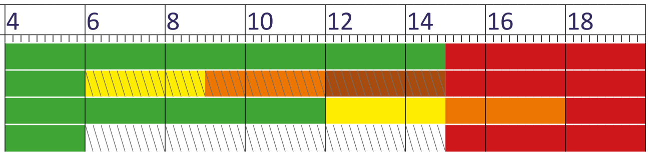
Chest VC_{max}		[m/s]
UN R94	ODB	HIII 50
UN R137	FWRB	HIII 5/50
IIHS	ODB/SOB	HIII 50
Euro NCAP	ODB/FWRB	HIII 5/50
C-NCAP	ODB/FWRB	HIII 50



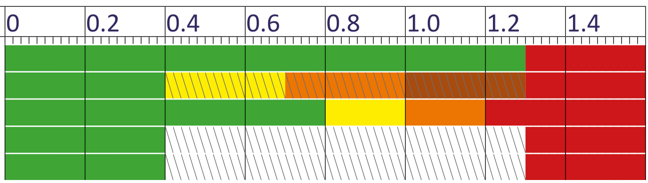
Femur F_{axial}		[kN]
UN R94	ODB	HIII 50
UN R137	FWRB	HIII 5
UN R137	FWRB	HIII 50
FMVSS 208	ODB	HIII 50
FMVSS 208	ODB/FWRB	HIII 5
FMVSS 208	OOP	HIII 5
Euro NCAP	ODB	HIII 50
Euro NCAP	FWRB	HIII 5
C-NCAP	ODB	HIII 50
JNCAP	ODB/FWRB	HIII 50
JNCAP	ODB	HIII 5



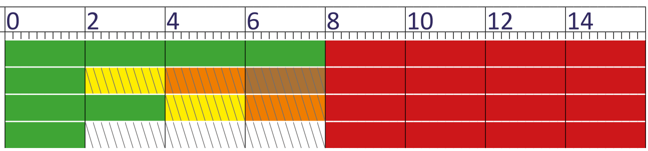
Knee Displacement		[mm]
UN R94	ODB	HIII 50
Euro NCAP	ODB	HIII 50
IIHS	ODB/SOB	HIII 50
C-NCAP	ODB/FWRB	HIII 50



Tibia Index		[-]
UN R94	ODB	HIII 50
Euro NCAP	ODB	HIII 50
IIHS	ODB/SOB	HIII 50
C-NCAP	ODB/FWRB	HIII 50
JNCAP	ODB/FWRB	HIII 50



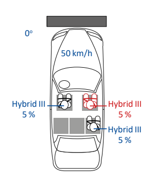
Tibia Compression		[kN]
UN R94	ODB	HIII 50
Euro NCAP	ODB	HIII 50
IIHS	ODB/SOB	HIII 50
C-NCAP	ODB/FWRB	HIII 50



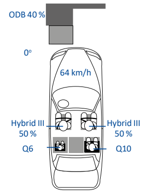
Safety Requirements for Rear Seats and Restraint Systems

Frontal impact tests with rear seat occupants

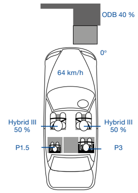
Euro NCAP FWRB



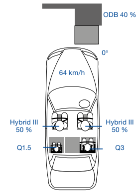
Euro NCAP ODB



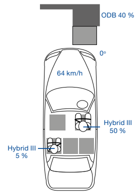
ANCAP ODB



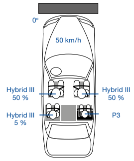
ASEAN NCAP ODB



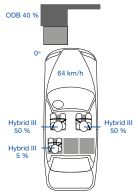
JNCAP ODB



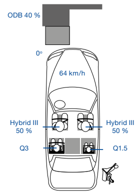
C-NCAP FWRB



C-NCAP ODB



Latin NCAP ODB

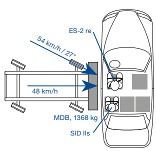


FMVSS 201: Head impact on belt anchorages
FMVSS 207: Seat stability
FMVSS 208: Belt system
FMVSS 209: Belt system
FMVSS 225: ISOFIX anchorages

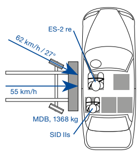
UN R14: Belt and ISOFIX anchorages
UN R16: Belt system
UN R17: Seat anchorages
UN R21: Head impact
UN R25: Head rests
UN R44: Child seats
UN R129: Child seats

Side impacts tests with rear seat occupants

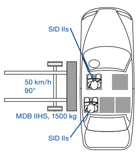
FMVSS 214



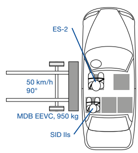
U.S. NCAP



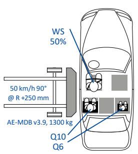
IIHS



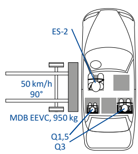
C-NCAP



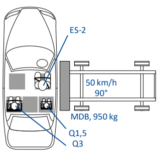
Euro NCAP MDB



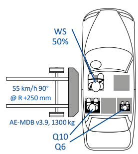
Latin NCAP MDB



ASEAN NCAP



KNCAP



Rear Seat Occupant Protection in Frontal Impact

Course Description

Rear seat occupant protection has been a low priority until the recent introduction of safety assessment for rear adult and child occupants by Euro NCAP. Now it has moved into the focus of research and development.

In addition to the Euro NCAP requirements, further NCAP ratings as well as legal requirements need to be considered in the design of the restraint systems. And real world aspects cannot be neglected either.

During the 1-day seminar legal and NCAP requirements for rear seat occupant protection in frontal impact will be discussed. Furthermore the dummies used in the assessment will be presented with an empasis on the Q6 and Q10 child dummies. For the most important load cases the relevant criteria and possible influcening parameters of the restraint system will be discussed and explored. Finally solutions for the design of the restraint system on rear seat will be shown.

Note: Only frontal impact load cases will be considered.

Course Objectives

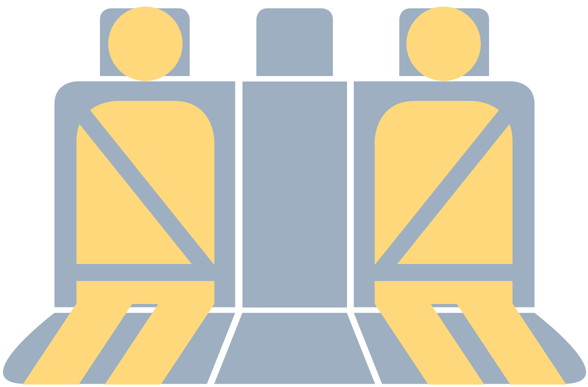
The objective of the seminar is to provide an understanding of the requirements and specifics in rear seat occupant protection, to provide the knowledge of test configurations and dummies, and to provide a view on state-of-the-art solutions.

Who should attend?

The seminar addresses simulation and test engineers, project engineers and project managers as well as the heads of development departments in the field of passive safety who work in R&D of occupant restraint-systems.

Course Contents

- Legal Requirements
- Requirements from consumer testing
- Dummies on the rear seat; Q6 and Q10 Child Dummies
- Relevant protection criteria for the most important load cases
- Solutions for restraint system design and optimization



Instructor

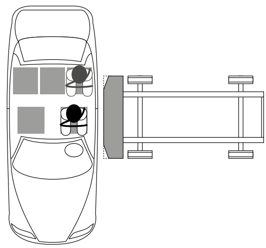
Dr.-Ing. Burkhard Eickhoff (Autoliv B.V. & Co. KG) studied mechanical engineering in Hannover (Germany) focusing on vehicle engineering and applied mechanics. Starting from 1999 he worked with Autoliv B.V. & Co. KG as a test engineer for sled and crash tests. Since 2003 he has been project manager in systems development (safety belt) of the same company. Since 2012 he has worked as a group leader at Autoliv. He is involved in the definition and assessment of new restraint systems and he conducts feasibility studies using system simulation as well as dynamical tests. Moreover he has a consultant role regarding restraint system design. He finished his doctoral thesis at the Helmut Schmidt University Hamburg in 2012 on the reduction of belt induced thorax deflection in frontal crashes.

Date

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
06.10.2017	2894	Alzenau	1 Day	740,- EUR till 08.09.2017, thereafter 890,- EUR	German

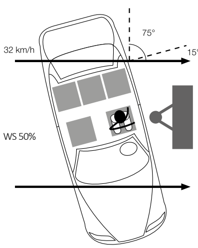
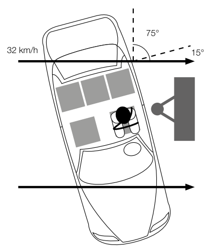
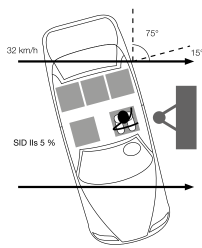
MDB Side Impact Test Procedures according to UN R95, Euro NCAP and IIHS

Requirement	UN R95	Euro NCAP	IIHS
Impact angle	lateral 90°		
MDB velocity	50 km/h		
Barrier (MDB)	EEVC	AE-MDB	IIHS
Mass	950 kg	1300 kg	1500 kg
Ground clearance	300 mm	300 mm (bumper 350 mm)	379 mm (bumper 430 mm)
Upper edge height	800 mm	800 mm	1138 mm
Width	1500 mm	1700 mm	1676 mm
Dummy front seat	ES-2 impact side	WS 50 % impact side	SID IIs impact side
Dummy rear seat		Q10 impact side Q6 far side	SID IIs impact side
Protection Criteria	Head HPC < 1000 Chest VC < 1.0 m/s Rib deflection D < 42 mm Abdomen sum of APF < 2.5 kN Pelvis PSPF < 6.0 kN	➲ page 28 (Adults) ➲ page 87 (Children)	➲ page 38



SafetyWissen by carhs.

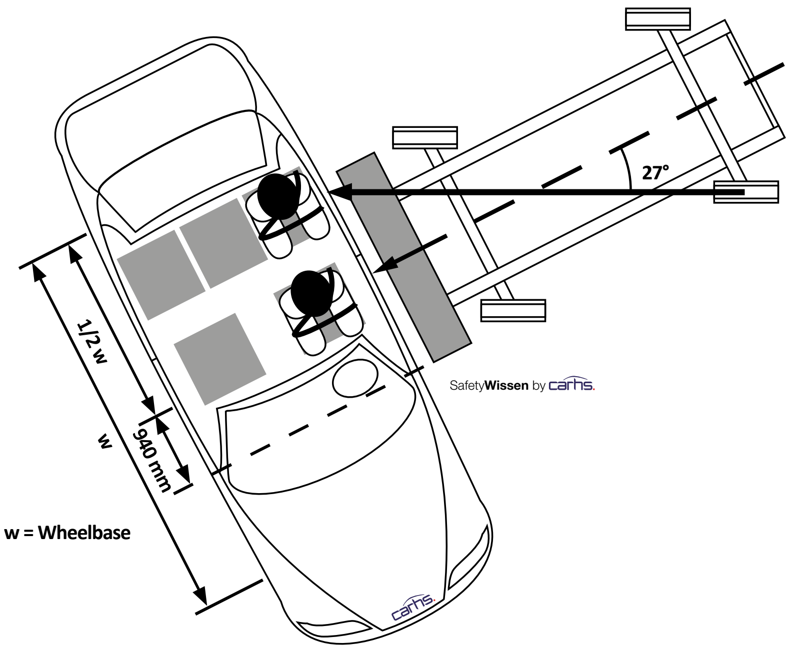
Pole Side Impact Tests according to Euro NCAP, UN R135, GTR 14 and FMVSS 214 new

Requirement	Euro NCAP	UN R135 / GTR 14	FMVSS 214 new	U.S. NCAP
Vehicle Velocity (on Flying Floor)	32 km/h	up to 32 km/h (26 km/h for vehicles up to 1.5 m width)	up to 32 km/h	32 km/h
Impact angle	oblique 75° on fixed pole			
Pole diameter	254 mm			
Dummy	WorldSID 50 % on impact side		ES-2 re or SID IIs (Build Level D) on impact side	SID IIs 5 % on impact side
Protection Criteria	➲ page 28	Head HIC_{36} < 1000 Shoulder $F_{lateral}$ < 3.0 kN Chest deflection < 55 mm Abdomen deflection < 65 mm Lower Spine Acc. < 75 g PSPF < 3.36 kN	SID IIs: HIC_{36} < 1000 Lower Spine Acc. < 82 g Pelvis Force < 5.525 kN ES-2 re: HIC_{36} < 1000 Chest deflection < 44 mm Abdominal Force < 2.5 kN PSPF < 6 kN	➲ page 33
Test Configuration	 SafetyWissen by carhs.			

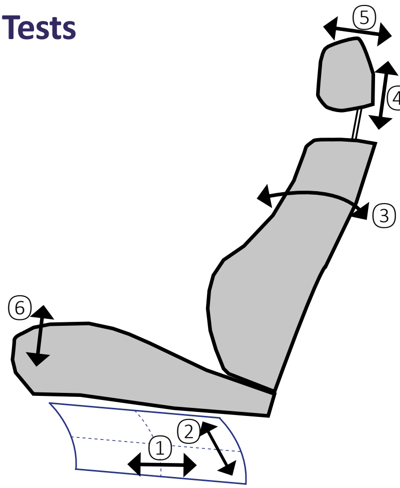
MDB - Side Impact Tests according to FMVSS 214 / U.S. NCAP

Requirement	FMVSS 214 new rule	U.S. NCAP	U.S. NCAP Upgrade[1]
Impact angle	lateral 90°, 27° crab angle		
Impact velocity	53±1 km/h (33.5 mph) (~47 km/h in 90° direction)	61.9 ±0.8 km/h (~55 km/h in 90° direction)	
Barrier	NHTSA MDB		
Mass	1368 kg		
Ground clearance	279 mm (Bumper 330 mm)		
Upper edge height	838 mm		
Width	1676 mm		
Dummy front seat	ES-2 re impact side	ES-2 re impact side	WorldSID 50 % (SBL F) impact side
Dummy rear seat	SID IIs (Build Level D) impact side	SID IIs (Build Level D) impact side	SID IIs (Build Level D) impact side
Protection Criteria	SID IIs: HIC_{36} < 1000 Chest acceleration < 82 g Pelvis force < 5.525 kN ES-2 re: HIC_{36} < 1000 Chest deflection < 44 mm Abdominal force < 2.5 kN Pelvis force < 6 kN	➲ page 33	Criteria not yet defined

[1] planned for model year 2019



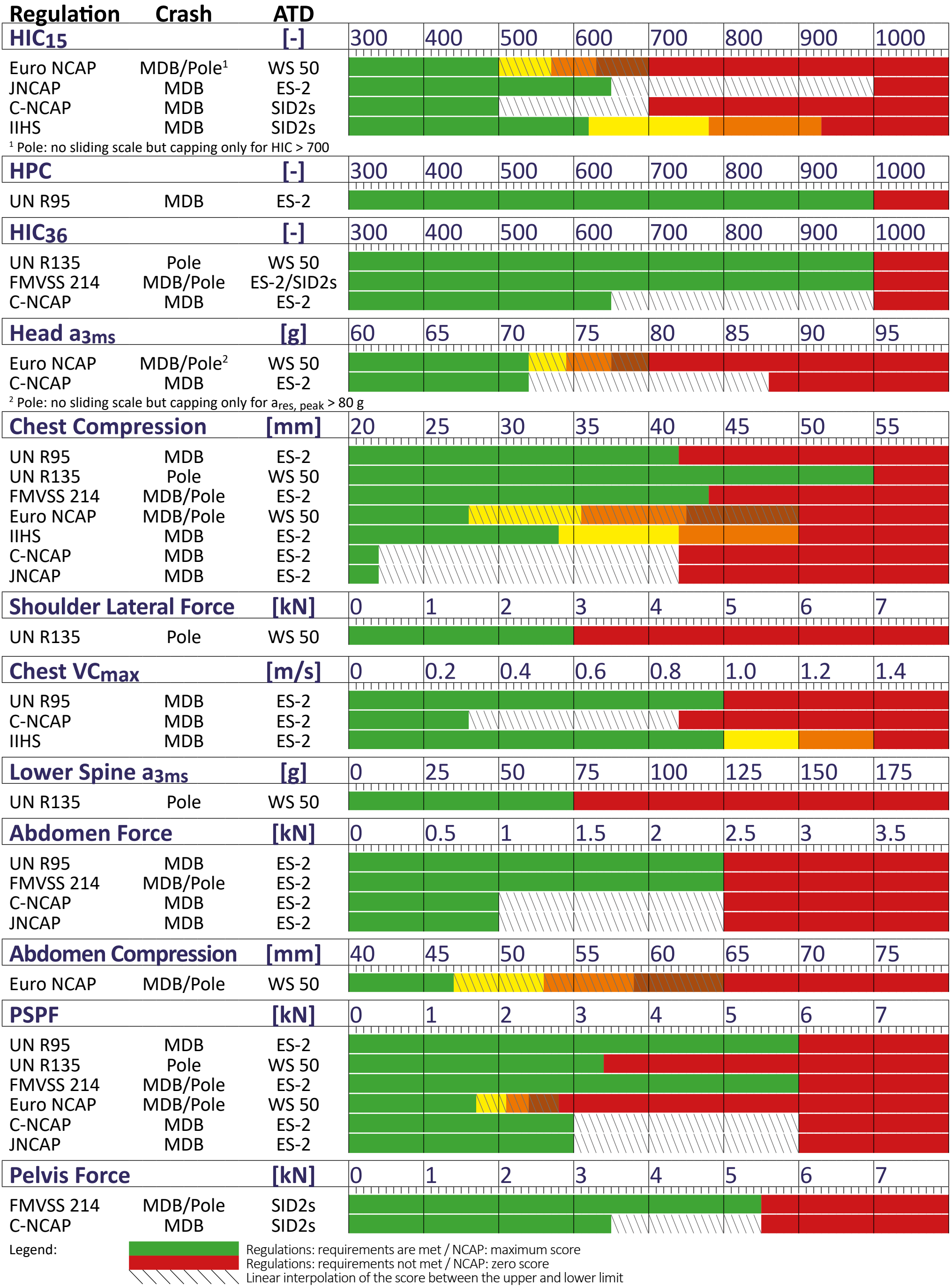
Seat Adjustments for Side Impact Tests



	① Seat Fore/Aft	② Seat Height	③ Seat Back Angle	④ Head Restraint Height	⑤ Head Restraint Fore/Aft	⑥ Seat Base Tilt
Euro NCAP MDB	mid + 20 mm	lowest	manuf. design position or 23°	mid	mid[1]	mid
Euro NCAP Pole	mid + 20 mm	lowest	manuf. design position or 23°	mid	mid[1]	mid
UN R95	mid	height of non-adjustable passenger seat or mid	manuf. design position or 25°	top surface level with head COG or uppermost	mid	mid
UN R135	mid + 20 mm	lowest	manuf. design position or 23°	uppermost or manuf. design position.	most rearward	mid
U.S. NCAP / FMVSS 214 ES-2RE	mid	lowest[2]	manuf. design position or 25°	uppermost	most forward	„absolute" mid[2]
U.S. NCAP / FMVSS 214 SID-2s	most forward position	mid	head at 0°	lowest	most forward	„absolute" mid[2]
U.S. NCAP / WorldSID 50	mid + 20 mm	lowest[2]	manuf. design position or 25°	uppermost	most forward	„absolute" mid[2]
ISO WorldSID 50	mid + 20 mm	lowest	manuf. design position or 23°	uppermost or manuf. design position.		

[1] If there is any interference with the rear of the dummy head, move the HR to the most rearward position.
[2] Seat base tilt adjustment ⑥ has priority w.r.t. seat height adjustment ②.

Side Impact Protection Criteria Compared



Please note that the values indicated in this graph may be rounded and that additional criteria may exist. Please take exact values and additional criteria from the tables for the respective regulation.

Side Impact - Requirements and Development Strategies

Course Description

In addition to the protection in a frontal impact, the protection in a side impact has a fixed place in the development of vehicles. Continuous aggravation of consumer tests and legal regulations, e.g. due to new pole tests (UN ECE-R135 and Euro NCAP), enhanced deformable barriers and the prospective introduction of World-SID-Dummies (5 / 50%ile) are causing a need to further improve side impact protection. In order to achieve this enhancement, it is necessary to get a much more profound understanding of the highly complex phenomena and modes of action in a side impact which goes far beyond the simple application of additional airbags.

The seminar provides a comprehensive overview of today's standard test procedures including country-specific variations, the legal regulations and the requirements of consumer protection as well as an outlook on changes in the near future. In addition, tools, measuring methods and criteria, and especially virtual methods such as crash and occupant simulation, as well as the analysis of the performance of the restraint systems will be discussed. Furthermore it will be explained how a target-oriented use of CAE-simulation and hardware tests can lead to optimal passenger values, while at the same time obeying to boundary conditions such as costs, weight and time-to-market. A part of the workshop with crash-data analysis finally deepens the understanding.

Who should attend?

The seminar addresses development engineers who are new in the field of side crash, or who have already gained some experience in the field of safety, as well as developers of assemblies that have to fulfil a crash-relevant function. Furthermore it is especially interesting for project managers and managers, who deal with side impact and who would like to gain a deeper understanding of this topic in order to use it for an improvement of procedures.

■

Course Contents

- Challenges of side impacts
- Side impact-relevant protection criteria. Legal tests (FMVSS 214, UN ECE R95, UN ECE R135, ...) Other tests (Euro NCAP, U.S. NCAP, further NCAPs, IIHS, car manufacturer-specific tests)
- Development methods and tools:
- Crash and occupant simulation, range of application and limitations.
- Performance of restraint systems in side impact:
- Analysis of the performance of protection and restraint systems in side impact. Discussion of the limitations, conflicts and problems.
- Development strategy for an optimal restraint system for side impact
- Target-oriented use of CAE-simulation and hardware tests
- Workshop with analysis of crash-data and discussion of the results

Instructors

Stephanie Wolter (BMW AG) studied Engineering Physics at the University of Applied Sciences Munich. Since 1995 she has been working at BMW AG in different functions in the field of side protection, such as pre-development, development of side airbags and as a project engineer in various car lines. Moreover, she represents BMW-Group in various national and international bodies that deal with side impact and other aspects of side protection, e.g. German Side Impact Working Group, ISO Working Groups, etc.

Bart Peeters Weem (BMW AG) studied mechanical engineering at the University of Technology in Eindhoven with focus on system and control. Since 2003 he has worked at BMW on passive safety development. First as Simulation Engineer, later as team leader and project referent. Since 2015 he is head of the development of full vehicle side impact protection for BMW 1-, 2- and 3-series, MINI and BMW-i.

Dates & Venues

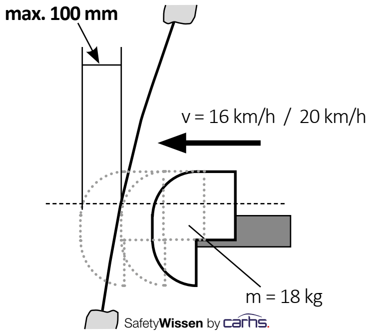
DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
04.-05.04.2017	2938	Gaimersheim	2 Days	1.290,- EUR till 07.03.2017, thereafter 1.540,- EUR	
07.-08.06.2017	2932	Alzenau	2 Days	1.290,- EUR till 10.05.2017, thereafter 1.540,- EUR	
28.-29.11.2017	2933	Alzenau	2 Days	1.290,- EUR till 31.10.2017, thereafter 1.540,- EUR	

FMVSS 226 - Ejection Mitigation

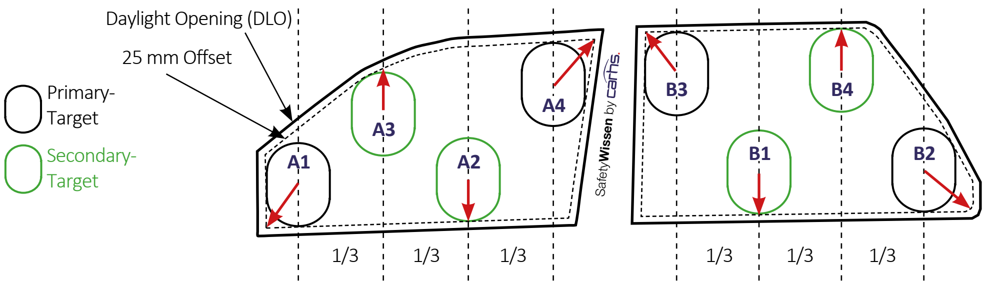
Test Procedure TP-226-00, Mar 2011

Requirements:

- At up to 4 impact test locations on each side window in the first 3 rows of seats the head excursion may not exceed 100 mm
- Tests at two impact velocities: 16 km/h and 20 km/h
- Head protection systems (e.g. curtain airbags) must be fired before the impact:
  - at 20 km/h with a time delay of 1.5 s prior to the impact
  - at 16 km/h with a time delay of 6 s prior to the impact
- Tests are done without glazing or with pre-damaged glazing
  - pre-damage: perforation in a 75 mm grid pattern
- Valid for vehicles with GVWR ≤ 4536 kg
- Phase-In: 2013 - 2017



Locating Targets:



Steps	Front Row Window	Rear Row Windows (SafetyWissen by carhs.)
1	Set Primary Target A1 in lower front corner	Set Primary Target B3 in upper front corner
2	Set Primary Target A4 in upper rear corner	Set Primary Target B2 in lower rear corner
3	Divide horizontal distance between A1 and A4 in thirds	Divide horizontal distance between B3 and B2 in thirds
4	Move A3 at the first third vertically upward	Move B1 at the first third vertically downward
5	Move A2 at the second third vertically downward	Move B4 at the second third vertically upward
6	Measure Distances D_x (horizontal) and D_z (vertical) of the target center points	
7	If D_x (A2 - A3) < 135 mm and D_z (A2 - A3) < 170 mm ⇨ Eliminate A3	If D_x (B1 - B4) < 135 mm and D_z (B1 - B4) < 170 mm ⇨ Eliminate B4
8	If D_x (A4 - A3) (or A2 if A3 was eliminated in step 7) < 135 mm and D_z (A4 - A3/2) < 170 mm ⇨ Eliminate A3/2	If D_x (B3 - B4) (or B1 if B4 was eliminated in step 7) < 135 mm and D_z (B3 - B4/1) < 170 mm ⇨ Eliminate B4/1
9	If D_x (A4 - A2) (or A3 if A2 was eliminated in step 8) < 135 mm and D_z (A4 - A2/3) < 170 mm ⇨ Eliminate A2/3	If D_x (B2 - B1) (or B4 if B1 was eliminated in step 8) < 135 mm and D_z (B2 - B1/4) < 170 mm ⇨ Eliminate B1/4
10	If D_x (A1 - A4) < 135 mm and D_z (A1 - A4) < 170 mm ⇨ Eliminate A4	If D_x (B3 - B2) < 135 mm and D_z (B3 - B2) < 170 mm ⇨ Eliminate B3
11	If only 2 targets remain: Measure absolute distance D the center points of the targets	
12	If D > 360 mm, set additional 3rd target on the center of the line connecting the targets	
13	If less than 4 targets remain, repeat steps 1-12 with the impactor rotated by 90 degrees. If this results in a higher number of targets use the rotated targets.	
14	If no target is found rotate the impactor in 5 degree steps, until it is possible to fit the impactor in the DLO-offset. Then place the center of the target as close to the geometric center of the DLO as possible.	

Head Impact on Vehicle Interiors

UN R21

Test Procedure
A pendulum equipped with a spherical impactor (165 mm) hits the interior parts in front of the driver and passenger (side, pedal and steering wheel excluded) with a velocity of 24.1 km/h.

Protection Criteria
$a_{3ms} < 80$ g; no failure of structure and sharp edges in impact zone

Pendulum test is not necessary, if it can be shown that there is no contact between head and the instrument panel in case of a frontal impact.
This can be done by crash tests, sled tests and/or numerical occupant simulation.
(See app. 8 of UN R21)

FMVSS 201U

Test Procedure TP-201-02, Jan 2016

Test Procedure
A Free Motion Headform (FMH) impactor hits the upper interior parts with a velocity of 24 km/h (A-, B-, C-pillar, roof etc.).

FMH Impactor Data
Mass of FMH impactor: 4.54 kg
Head form according to SAE J 921 and J 977 including triaxial acceleration sensor.

Protection Criteria

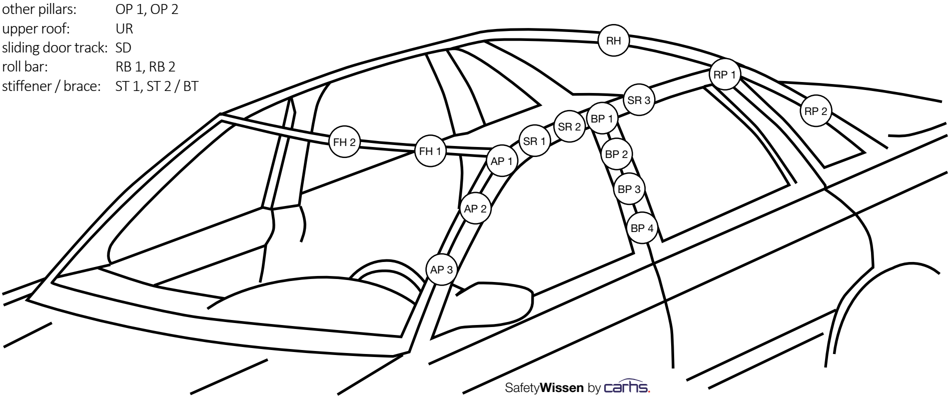
HIC Calculation $$HIC = sup_{t_1,t_2} \left\{ \left[\frac{1}{(t_2-t_1)} \int_{t_1}^{t_2} a dt \right]^{2,5} (t_2-t_1) \right\}$$ $t_2-t_1 < 36$ ms; a [g]; t [s]

HIC value for FMH $HIC(d) = 0.75446\ HIC + 166.4$

HIC(d) must not exceed 1000.

24 points defined for impact according Test Procedure TP-201U-02 (each side, left and right)

other pillars: OP 1, OP 2
upper roof: UR
sliding door track: SD
roll bar: RB 1, RB 2
stiffener / brace: ST 1, ST 2 / BT



Head Impact on Vehicle Interiors: FMVSS 201 and UN R21

Course Description

To prevent injuries resulting from impacts of the occupants' heads on vehicle interior parts, these parts need to be designed in a way which allows sufficient deformation space to reduce the loads on the head. Internationally there are two important regulations regarding the design of interiors, such as cockpits, roof and door liners: The U.S. FMVSS 201 and the Regulation UN R21. Both regulations stipulate requirements concerning the maximum head acceleration or the HIC in impacts on interior parts.

The objective of this course is to provide an overview of the legal requirements and to show how these can be fulfilled. The focus of the seminar is on the development process and the development tools and methods. In particular the interaction of testing and simulation will be described and different design solutions will be discussed. Typical conflicts of objectives in the design - e.g. to fulfil NVH requirements, static stiffness, or misuse, while fulfilling the safety standards at the same time - are addressed in this seminar. Examples of practical solutions will be shown and discussed.

In addition, the development according to the head impact requirements in the overall-context of vehicle development is described in this seminar.

In a workshop exemplary head impact locations in a vehicle interior and impact areas on a dashboard are determined.

Who should attend?

This seminar is especially suited for engineers and technicians who work on the development of vehicle interior parts and who want to become familiar with the safety requirements that are relevant for these parts.

Course Contents

- Introduction
- Rules and regulations concerning head impact
  - FMVSS 201
  - UN R21
- Development tools
  - Numerical Simulation
  - Test
- Workshop: Determination of impact locations in a vehicle
- Development process and methods
  - Solving of conflicts of objectives
  - Typical deformation paths, padding materials

Instructors

Torsten Gärtner (Adam Opel AG) has been working as a simulation expert since 1997. From numerous projects he has extensive experience in the field of occupant simulation and interior safety. He is Technical Lead Engineer Safety Analytics at Adam Opel AG. Before that he worked as department manager for safety with Tecosim GmbH and spent 10 years in various management positions with carhs gmbh.

Karsten Wolff (Continental Safety Engineering International GmbH) studied Traffic Safety Technology at the University of Wuppertal. During his studies he worked at BGS (Böhme & Gehring Sicherheitstechnik) in the fields of dummy calibration and head impact. In 1998 he joined Continental Safety Engineering International as an engineer. In 2000 he established FMVSS201U testing at Continental and in 2002 he introduced pedestrian protection testing. Later on UN ECE R21 and FMVSS201L testing was added, followed by ejection mitigation. In 2003 he became team leader for pedestrian protection and interior head impact, in 2009 he started leading the development and testing for FMH und pedestrian protection and since 2012 he has been team leader of the competence center for pedestrian protection and interior head impact. In this role he acts as a link between simulation, project and testing.

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
05.04.2017	2829	Alzenau	1 Day	740,- EUR till 08.03.2017, thereafter 890,- EUR	
12.06.2017	2898	Alzenau	1 Day	740,- EUR till 15.05.2017, thereafter 890,- EUR	
27.09.2017	2931	Alzenau	1 Day	740,- EUR till 30.08.2017, thereafter 890,- EUR	

12th PraxisConference
Pedestrian Protection

The PraxisConference Pedestrian Protection is held every June or July with over 150 participants, including delegates from all major OEMs. It is the world's largest expert meeting in the field of pedestrian protection. The intensive discussions at the info-points and between the presentations show that the participants value the innovative conference concept. Highlights of the event are the demonstrations in the laboratory of Germany's Federal Highway Research Institute and the OEM's presentations of pedestrian protecting solutions implemented in current car models.

Although the industry has been working on pedestrian protection for many years now, the constant development of the requirements (regulations and NCAP) continuously raises new questions that will be answered during this conference.
Expert speakers provide concentrated information regarding current and future requirements, latest research findings and technical solutions. Both, testing and numerical simulation are covered in the conference presentations.
In addition to this the conference offers hands-on praxis session in the laboratory. Here, test equipment and impactors are demonstrated and explained in detail. The preparation, execution and analysis of pedestrian impact tests are shown in live demonstrations.

Conference Topics:

- Current status and future development of the regulations (UN R127, GTR 9)
- Global consumper protection requirements for pedestrian protection
- Future development of impactors
- Pedestrian AEB systems
- Pedestrian safety techologies (active bonnets, airbags)
- Test equipment

Who should attend?

The PraxisConference is suited for pedestrian protection experts from throughout the industry. Even beginners will find the event an excellent opportunity to quickly acquire theoretical and practical knowledge and become part of the expert community.

Facts

DATE	28.- 29. June 2017
HOMEPAGE	www.carhs.de/pkf
VENUE	Bundesanstalt für Straßenwesen, Brüderstraße 53, 51427 Bergisch Gladbach
LANGUAGE	German with simultaneous translation into English
PRICE	1.450,- EUR till 31.05.2017, thereafter 1.690,- EUR

Co-hosted with

BGS Böhme & Gehring GmbH

Pedestrian Protection - Development Strategies

Course Description

Phase 2 of the EU regulation on pedestrian safety was introduced, Japan recognizes the UN Regulation 127 and Euro NCAP annually adjusts details in its pedestrian rating protocols. Currently, the greatest challenge regarding pedestrian protection in the vehicle development process is to generate a face-lift of successor model based on a car that had received a 5 star Euro NCAP rating prior to 2010, that will be type approved according to phase 2 of the European regulation and also continue to receive a 5 star rating according to Euro NCAP's latest protocols. Stricter injury criteria, modified testing areas and the testing of vehicles that were previously not tested because of their weight, require the thorough knowledge of the requirements and a strict implementation of the requirements in the development process.

In the introduction the seminar informs about the different impactors that are used for pedestrian safety testing. Thereafter the various requirements (regulations and consumer tests) are explained and compared.

The focus of the seminar is on the development strategy: Which decisions have to be taken in which development phase? What are the tasks and priorities of the person in charge of pedestrian protection? As a background, ideas and approaches towards the design of a vehicle front end in order to meet the pedestrian protection requirements are discussed. In addition to that, the seminar explains how the function of active bonnets can be proven by means of numerical simulation. This includes both, the pedestrian detection that need to be proven with various impactors or human models, as well as the proof that the bonnet is fully deployed at the time of impact.

Who should attend?

The seminar is intended for development, project or simulation engineers working in the field of vehicle safety, dealing with the design of motor vehicles with regard to pedestrian protection.

Course Contents

- Introduction with an overview of current requirements regarding pedestrian protection
  - Legal requirements (EU, UN Regulations, Japan, GTR)
  - Consumer tests (Euro NCAP, JNCAP, KNCAP)
- Presentation and discussion of the design and application of the impactors
  - Leg Impactors (Flex PLI, EEVC, Upper Legform)
  - Head Impactors (Child head, Adult head)
- Methods in numerical simulation, testing and system development
- Requirements on the design of vehicle front ends for pedestrian protection
- Solutions to fulfill the requirements
  - Passive solutions
  - Active solutions (active bonnets, airbags)
- Development strategy
  - Interaction between simulation and testing
  - Integration in the vehicle development process

Instructor

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Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
29.03.2017	2819	Alzenau	1 Day	740,- EUR till 01.03.2017, thereafter 890,- EUR	
31.05.2017	2895	Alzenau	1 Day	740,- EUR till 03.05.2017, thereafter 890,- EUR	
10.10.2017	2941	Gaimersheim	1 Day	740,- EUR till 12.09.2017, thereafter 890,- EUR	

Pedestrian Protection

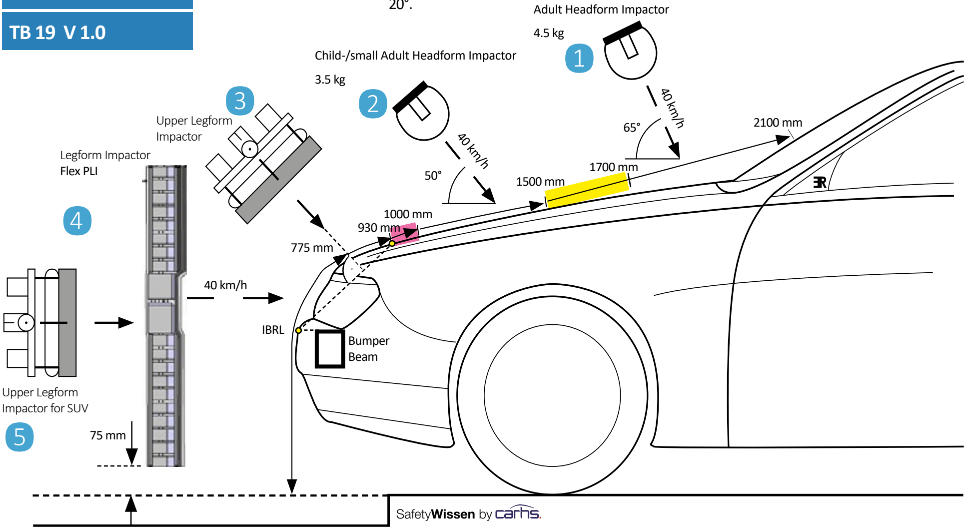
Pedestrian Protection Test Procedures in Euro NCAP

Protocol Version 8.3

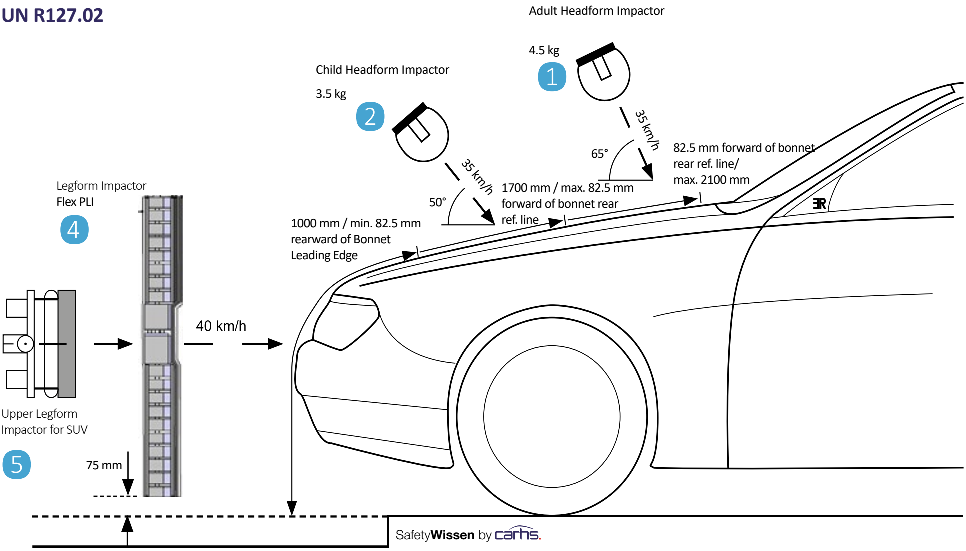
TB 19 V 1.0

Where the bonnet leading edge reference line (BLERL) is located between WAD 930 mm and WAD 1000 mm, an additional test with the child headform will be performed on the BLERL at a speed of 40 km/h under 20°.

Points to be tested that lie between WAD 1500 und 1700 are tested with child-/small adult headform impactor, if the points are on the moveable/hinged bonnet top. Otherwise the adult headform is used.



Pedestrian Protection Test Procedures according to UN R127.02



Test Procedures and Protection Criteria for Pedestrian Protection

Test Method	Parameter	Euro NCAP U.S. NCAP[8] max. score	Euro NCAP U.S. NCAP[8] zero score	JNCAP max. score	JNCAP zero score	KNCAP C-NCAP[11] max. score	KNCAP C-NCAP[11] zero score	EU Regulations 78/2009 and 631/2009 Phase 2	UN R127	GTR No. 9	Japan Article 18 Attachment 99
1 Adult Headform 4.5 kg Ø 165 mm	α_A (°)	65		65		65		65	65	65	65
	V_A (km/h)	40		40		40		35	35	35	35
	WAD (mm)	1700 (1500)[1] - 2100		1700 - 2100		1700 - 2100		1700 - 2100[10]	1700 - 2100[10]	1700 - 2100[10]	1700 - 2100
	on Windscreen	yes		yes		yes		no	no	no	no
	HPC/HIC (-)	650	1700	650	1700	650	1700	1000 / 1700[3]	1000 / 1700[3]	1000 / 1700[3]	1000 / 1700[3]
2 Child Headform 3.5 kg Ø 165 mm	α_C (°)	50		50 (20[2])		50		50	50	50	50
	V_C (km/h)	40		40		40		35	35	35	35
	WAD (mm)	1000 - 1700(1500)[1]		1000 - 1700		1000 - 1700		1000 - 1700[10]	1000[9] - 1700[10]	1000 - 1700[10]	1000 - 1700
	on Windscreen	yes		yes		yes		no	no	no	no
	HPC/HIC (-)	650	1700	650	1700	650	1700	1000 / 1700[3]	1000 / 1700[3]	1000 / 1700[3]	1000 / 1700[3]
3 Upper Legform 10.5 kg	α_U (°)	90 w.r.t. IBRL[4] - WAD 930									
	V_U (km/h)	20 - 33									
	Sum of forces (kN)	5 kN	6 kN								
	Bending Moment (Nm)	285 Nm	350 Nm								
4 Lower Legform[7]	Legform	Flex PLI		Flex PLI		Flex PLI		EEVC	Flex PLI	Flex PLI	Flex PLI
	V_L (km/h)	40		40 (44)[5]		40		40	40	40	40
	Ground clearance d (mm)	75		75		75		25	75	75	75
	Acceleration (g)							170 (250)[6]			
	Bending angle (°)							19			
	Shearing (mm)							6			
	Tibia Bending (Nm)	282	340	202	306	282	340		340 (380)[6]	340 (380)[6]	340 (380)[6]
	MCL Elongation (mm)	19	22	14.8	19,8	19	22		22	22	22
	ACL/PCL Elongation (mm)	10	10	0	13	10	10		13	13	13
5 Upper Legform[7] 9.5 kg	V_L (km/h)	40				40		40	40	40	40
	Sum of forces (kN)	5	6			5	7.5 / 6[12]	7.5	7.5	7.5	7.5
	Bending Moment (Nm)	285	350			300 / 285[12]	510 / 350[12]	510	510	510	510

[1] Points to be tested that lie between WAD 1500 and 1700 are tested with child-/small adult headform impactor, if the points are on the moveable/hinged bonnet top. Otherwise the adult headform is used.
[2] Between "Blue Line" and 1000 mm
[3] The HPC shall not exceed 1000 over one half of the child headform test area and, in addition, shall not exceed 1 000 over 2/3 of the combined child and adult headform test areas. The HPC for the remaining areas shall not exceed 1700 for both headforms.
[4] IBRL = Internal Bumper Reference Line
[5] Test velocity will be increased when leg impact is introduced in legal test.
[6] In an area no wider than 264 mm.
[7] For vehicles with a lower bumper height < 425 mm the lower legform test 4 is applied. For vehicles with a lower bumper height ≥ 500 mm the upper legform test 5 is applied. For vehicles with a lower bumper height ≥ 425 mm an < 500 mm the impactor is at the choice of the manufacturer.
[8] Proposed U.S. NCAP rating to be implemented in 2018 for model year 2019 vehicles.
[9] Minimum 82.5 mm rearward of Bonnet Leading Edge
[10] Maximum 82.5 mm forward of Bonnet Rear Reference Line
[11] Introduction of pedestrian test in C-NCAP is planned in 2018
[12] C-NCAP

Euro NCAP - Pedestrian Protection: Head and Leg Impact Grid Method

Head Impact

Between WAD 1000 and WAD 2100 impact points are located on a fixed 100 mm grid, the selection of „Worst Case“ points by the test institute is no longer required. The manufacturer provides a result prediction (points) for the Grid-Points. Euro NCAP verifies 10 randomly selected points, the manufacturer can nominate up to 10 additional randomly selected points. A tolerance of 10 % is applied to the verification tests, i.e. even if the actual HIC is 10 % above or below the margins of the predicted score, the predicted score is applied. At the verification points the actual test result is divided by the manufacturer's prediction. This so called correction factor is applied to all the grid points to obtain the final score:

$$\frac{\text{Actual tested score}}{\text{Predicted score}} = \text{Correction Factor}$$

Per Grid-Point 0 - 1 points are available according to the following scheme:

	HIC_{15}	< 650	1.00 Point
650 ≤	HIC_{15}	< 1000	0.75 Points
1000 ≤	HIC_{15}	< 1350	0.50 Points
1350 ≤	HIC_{15}	< 1700	0.25 Points
1700 ≤	HIC_{15}		0.00 Points

„Default“ Results

Grid points on the A-pillars are defaulted to red = 0 points. Grid points on the windscreen that have distance of more than 165 mm from the windscreen base are defaulted to green = 1 point. Defaulted locations are not included in the random selection of verification tests. Where the vehicle manufacturer can provide evidence that shows an A-pillar is not red, those grid points will be considered in the same way as other points.

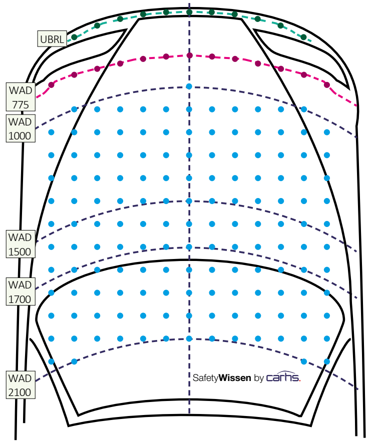
Unpredictable Grid Locations: blue Zones

In the following areas

- Plastic scuttle
- Windscreen wiper arms and windscreen base
- Headlamp glazing
- Break-away structures

the manufacturer may define a „blue zone“ consisting of up to 2 adjacent grid points, for which no prediction is made. A maximum of eight zones may be blue over the entire headform impact area.

The laboratory will choose one blue point to assess each zone. The test results of blue points will be applied to all the grid point(s) in each zone.



Total score:

The total score will be calculated as follows:

	∑Predicted Score x Correction Factor
+	∑Default Scores
+	∑Scores from Blue Zones
=	Total
÷	Number of Grid Points
=	Percentage of max. achievable score
x	24 (Maximum achievable score)
=	Total Score for Headform Test

Leg Impact

For leg impact a 100 mm grid on WAD 775 (Upper Legform) respectively on Upper Bumper Reference Line (Flex PLI Legform) is used. Euro NCAP selects either the centerline point or an adjacent point as a starting point for testing. Starting from this position every second grid point will be tested. Symmetry is applied across the vehicle. Grid points that have not been tested will be awarded the worst result from one of the adjacent points. Manufacturers may sponsor additional test for those points that are not tested (in advance). Per Grid point up to 1 point is awarded. For the Upper Legform the score is based upon the worst performing parameter (Sum of Forces / Bending moment). For the Legform the 1 point per grid point is divided into two independent assessment areas of equal weight (0.5 Pts./each): Tibia moments and ligament elongations.

Total score:

The total score for the Upper/Lower Legform tests will be calculated as follows:

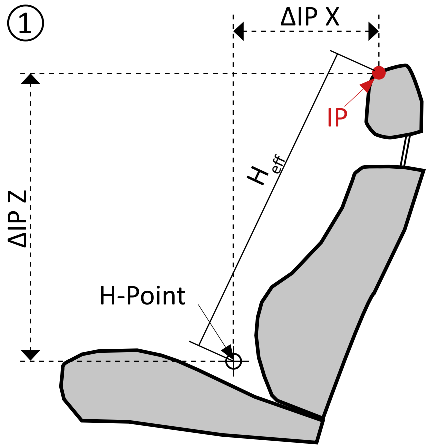
	∑Scores of all Grid Points
÷	Number of Grid Points
=	Percentage of max. achievable score
x	6 (Maximum achievable score)
=	Total Score for Legform Test

more about the impactors ➲ page 106

Euro NCAP Rear Seat Whiplash Assessment

Assessment Protocol Version 7.0.3

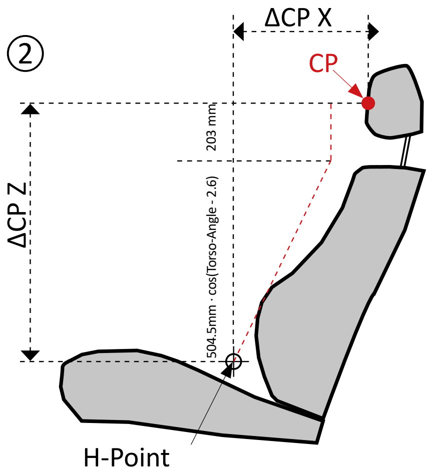
Testing Protocol Version 1.0



① **Effective Height H_{eff} requirements for the headrest**:
in highest position ≥ 770 mm
<u>and</u>
in worst case position ≥ 720 mm

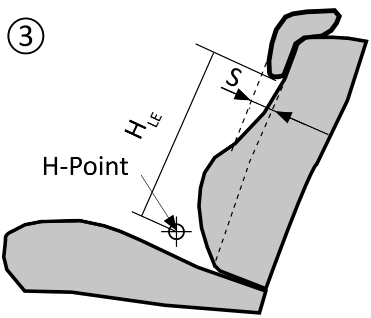
Calculation of H_{eff}:
H_{eff} = ΔIP X · sin (Torso-Angle) + ΔIP Z · cos (Torso-Angle)
IP: Intersection Point

Determination of IP X and IP Z:
IP X = 88.5 · sin (Torso-Angle- 2.6) + 5 + CP X
IP Z = uppermost intersection of the headrest contour in the seat centerline with a vertical line through IP X



② **Backset ΔCP X requirements for the headrest**
in mid position
<u>and</u>
in worst case position:

ΔCP X ≤ 7.128 · Torso-Angle + 153
CP: Contact Point



③ **Requirements for the non-use position of the headrest:**
1) > 60° rotation of the headrest in non-use position
2) Δ Torso-Angle use / non-use > 10°
3) Height of lower edge of the headrest H_{LE}:
   250 mm ≤ H_{LE} ≤ 460 mm
   with H_{LE} = ΔX · sin (Torso-Angle) + ΔZ · cos (Torso-Angle)
4) Thickness of the lower edge of the headrest S ≥ 40 mm

Score if the requirements (see above) are met:
The outboard seating positions of rear seating rows are assessed. Any centre seating position needs to comply with the requirements of UN R17-08.

Parameter	Points per seat
① H_{eff}	1.5
② ΔCP X_{mid}	1*
② ΔCP $X_{worstcase}$	0.5*
③ Non-Use	1*
max. total	4
Scaling	1/4n (n=number of seats)

* only if H_{eff} requirements are met

Euro NCAP Front Seat Whiplash Assessment

Assessment Protocol Version 7.0.3 | **Testing Protocol Version 3.2**

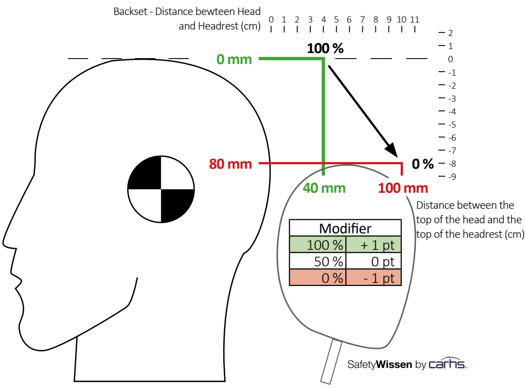
Seat Performance Criteria

Whiplash Test	Low Severity Pulse			Medium Severity Pulse			High Severity Pulse		
SafetyWissen by carhs.	Higher perfor-mance	Lower perfor-mance	Capping Limit	Higher perfor-mance	Lower perfor-mance	Capping Limit	Higher perfor-mance	Lower perfor-mance	Capping Limit
NIC	9.00	15.00	18.30	11.00	24.00	27.00	13.00	23.00	25.50
Nkm	0.12	0.35	0.50	0.15	0.55	0.69	0.22	0.47	0.78
Rebound velocity (m/s)	3.0	4.4	4.7	3.2	4.8	5.2	4.1	5.5	6.0
Upper Neck $F_{x,shear}$ (N)	30	110	187	30	190	290	30	210	364
Upper Neck $F_{z,tension}$ (N)	270	610	734	360	750	900	470	770	1024
T1 acceleration* (g)	9.40	12.00	14.10	9.30	13.10	15.55	12.50	15.90	17.80
T-HRC (ms)	61	83	95	57	82	92	53	80	92

* up to T-HRC (=Time to Head Restraint Contact)

If the Higher Performance Limit is reached, 0.5 points are awarded per criterion. A sliding scale is used between Higher and Lower Performance Limit (0.5 .... 0 points). Only the maximum score from either T1 acceleration or head restraint contact time (T-HRC) is used in the assessment. If the capping limit is exceeded by one criterion, the entire test is rated with zero points.

Geometry assessment



Worst Case Geometry

1/n points (where n = the number of front seats) will be available for each front seat scoring more than 0 points in the worst case (= lowest and rearmost position) geometry assessment.

Seat Stability Modifier

The high severity pulse is subject to an additional seatback deflection assessment where a 3 point penalty is applied to seats with a rotation of 32° or greater

Dummy Artefact Modifier

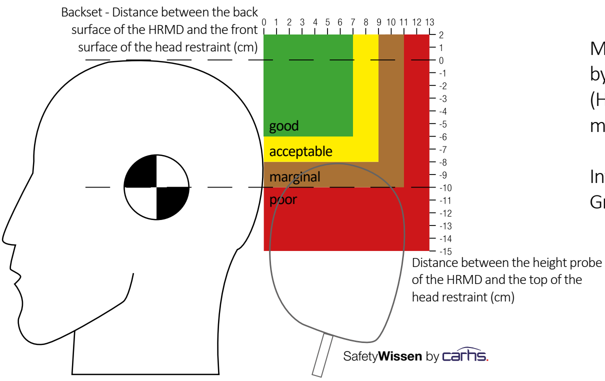
A two point negative modifier is applied as a means of penalising any seat that, by design, places unfavourable loading on other body areas or exploits a dummy artefact.

The assessment is based on the worst performing parameter from either the height or backset.

Overall Rating

For the overall rating (➲ page 30) the total of max. 11 points (3 per pulse + 1 Geometry + 1 Worst Case Geometry) is scaled by the factor 2/11 and is part of the Adult Occupant Protection rating.

Static Geometry Assessment by IIWPG / IIHS



Measurement of the head restraint position by a „Head Restraint Measuring Device“ (HRMD) and rating in good, acceptable, marginal and poor.

International Insurance Whiplash Prevention Group (IIWPG)

Learn more about IIHS's static and dynamic assessment ➲ page 37

Whiplash Testing and Evaluation in Rear Impacts

Course Description

In real-world accidents, distortions of the cervical spine or so-called whiplash injuries following a rear impact are among the most expensive injuries for the insurance industry. About 75 % of all injury costs of the insurers are caused by whiplash injuries in highly-motorized countries. About 80 % of all injuries in a rear impact are whiplash-injuries. This is why this type of injury – even though it is neither very serious nor lethal – has reached a high priority in the endeavors to develop test procedures and assessment criteria which help in designing constructive measures in the car in order to avoid this type of injury.

As an introduction, this seminar refers to the different accident data for whiplash injuries, which offer many realizations but no consistent pattern with regard to the biomechanical injury mechanisms. However, some organizations – mainly from the field of consumer information and insurance institutes – are working on the development of test procedures and assessment criteria. The most active ones are Thatcham (UK) and IIHS (USA) which are united in the group IIWPG (International Insurance Whiplash Prevention Group), SNRA and Folksam (Sweden) and the German ADAC.

In 2008 Euro NCAP has introduced a whiplash test procedure as part of its rating system. In 2014 an additional assessment for the rear seats was added. The Euro NCAP assessment will be explained in detail in the seminar. Furthermore, the EEVC working group 20 is active as a consulting authority concerning whiplash injuries for the legislation in Europe.

The new Global Technical Regulation No. 7 (Head Restraints) is unsatisfactory from the European point of view. Therefore the United Nations work on a second phase of this regulation. The focus of this work is on improving the BioRID dummy and on the definition of so called Seat Performance Criteria.

All discussions about the assessment of whiplash injuries within the framework of consumer information have in common, that the protection effect in a rear-end impact needs to be examined in an isolated vehicle seat by means of a sled test using a generic acceleration pulse. It turns out to be problematic, however, that presently there is no traumato-mechanical explanation of the phenomenon "whiplash injury" and that all the currently discussed dummy-criteria with the respective limit values follow a so-called "black-box approach". Experts try to correlate the measured dummy criteria with the findings from accident data and to thus derive limit values. In this context the available dummy-technology with the different measuring devices and criteria, as well as the proposed limit values are going to be presented.

In the last part of the seminar different seat design concepts (energy-absorbing, respectively geometry-improving), subdivided into active and passive systems will be introduced, and their advantages and disadvantages will be discussed.

Who should attend?

The seminar addresses development engineers who are new in the field of rear impacts or who have already got some experience in the field of safety, as well as developers of subassemblies which have to fulfill a crash-relevant function. It is furthermore especially interesting for project managers and managers who deal with the topic of rear-end impacts and who would like to obtain a better knowledge of this subject in order to use it for an improvement of procedures.

Course Contents

- Introduction into the characteristics of a rear-end impact
- Overview of the most important whiplash requirements
- Injury criteria
- Dummy-technology for rear impacts
- Presentation of the Euro NCAP and FMVSS 202-dynamic test procedures
- Outlook on possible harmonization-tendencies
- Explanation of the possible design measures in car seats

Instructor

Thomas Frank (LEAR Corporation GmbH) joined the passive safety department of Lear Corporation in 2002 after graduating from the Technical University of Berlin in physical engineering sciences. At Lear Thomas Frank initially worked as a test engineer in crash testing, later he developed head rests. Today he is expert for low speed rear impact safety. In his position he guides the seat development with respect to meet whiplash protection requirements in regulations and consumer tests.

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
20.02.2017	2896	Alzenau	1 Day	740,- EUR till 23.01.2017, thereafter 890,- EUR	
04.09.2017	2897	Alzenau	1 Day	740,- EUR till 07.08.2017, thereafter 890,- EUR	

Child Occupant Protection Assessment in Euro NCAP

Protocol Version 7.1

max. 49 points

Dynamic assessments

Testing:

Q6: The Q6 dummy shall be seated in an appropriate CRS for a six year old child or a child with a stature of 125 cm. This will be either the CRS recommended by the vehicle manufacturer, or if there is no recommendation, a suitable CRS from the top pick list.

Q10: The Q10 dummy shall be seated on a booster cushion only. This will be the booster cushion recommended by the vehicle manufacturer. Where the vehicle manufacturer recommends a high back booster with detachable backrest it will be used without backrest. If there is no recommendation for a booster cushion, one will be chosen by Euro NCAP from a list of suitable options contained in the Technical Bulletin TB012.

Preconditions: Where any of the following events occur zero points will be awarded to the dummy.

Frontal impact: During the forwards movement of the dummy only, the diagonal belt slips off the shoulder

Frontal impact: The pelvis of the dummy submarines beneath the lap section of the belt or the lap section prevents the dummy from moving upwards during rebound and is no longer restraining the pelvis.

Frontal and side impacts: The dummy pelvis does not remain in the booster seat /cushion and is not correctly restrained by the lap section of the seatbelt.

Frontal and side impacts: CRS does not remain within the same seating position or is no longer correctly restrained by the adult belt.

Frontal and side impacts: There is any breakage or fracturing of load-bearing parts of the belt system including buckles, webbing and anchorage points.

Frontal and side impacts: There is any breakage or fracturing of any seat belt lock-offs, tethers, straps, ISOFIX anchorages or any other attachments which are specifically used to anchor the CRS to the vehicle fail.

Modifier: If, during the forwards movement of the dummy, the diagonal belt moves into the gap between the clavicle and upper arm with folding of the belt webbing, a penalty of **-4 points** will be applied to the overall dummy score of the impact in which it occurs.

max. 24 points

Dummy	Region	Points	Criteria
Frontal impact (ODB)			
Q6 / Q10	Head	4	HIC_{15}[1] ≤ 500, a_{3ms} ≤ 87 g
		0	HIC_{15}[1] ≥ 700, a_{3ms} ≥ 100 g
		- 2 (Modifier[2])	Head forward excursion > 450 mm
		- 4 (Modifier)	Head forward excursion > 550 mm
	Neck	2	Upper Neck F_z ≤ 1.7 kN
		0	Upper Neck F_z ≥ 2.62 kN
	Chest	2	a_{3ms} ≤ 41 g
		0	a_{3ms} ≥ 55 g
Side impact (MDB)			
Q6 / Q10	Head	2	HIC_{15}[1] ≤ 500, a_{3ms} ≤ 72 g
		0	HIC_{15}[1] ≥ 700, a_{3ms} ≥ 88 g
	Neck	1	Upper Neck F_{res} < 2.4 kN (Q6) Upper Neck F_{res} < 2.2 kN (Q10)
		0	Upper Neck F_{res} ≥ 2.4 kN (Q6) Upper Neck F_{res} ≥ 2.2 kN (Q10)
	Chest	1	a_{3ms} < 67 g
		0	a_{3ms} ≥ 67 g

Installation of CRS

max. 12 pt.

Universal CRS	points	4
ISOFIX CRS	points	2
i-Size CRS	points	4
manufacturer recommended CRS	points	2

Vehicle based assessment

Preconditions:

Provision of three-point seat belts on all passenger seats

Tables in the vehicle handbook stating clearly, which seating positions are suitable or not suitable for Universal / ISOFIX / i-Size CRS

Where a passenger frontal airbag is fitted (both front and rear seats if applicable), the CRS tables in the vehicle handbook must clearly indicate that when these passenger airbags are active the seat is NOT suitable for any rearward facing CRS.

max. 13 points

Compatibility of the 2nd row outboard seats with Gabarit according to UN ECE R16 Annex 17 - Appendix 1	points	1
Compatibility of all other passenger seats with Gabarit according to UN ECE R16 Annex 17 - Appendix 1	points	1
2 seats with i-Size and TopTether marking	points	2
3 independent seats with i-Size and TopTether marking	points	1
2 or more seating positions are suitable for fully independent use with the largest size of rearward facing (Class C) ISOFIX CRS, Fixture (CRF) ISO/R3,	points	1
passenger airbag warning marking and manual / automatic disabling	points	2 / 4
integrated CRS	points	1 (1 CRS) / 3 (2 or more CRS)

[1] HIC_{15} is only applied if there is hard head contact, otherwise the score is based on a_{3ms} only
[2] Q10 only

Child Occupant Protection Assessment in Latin NCAP

Protocol Version 3.1

Requirements for points for Child Protection Rating: child seats (CRS) must be recommended by the vehicle manufacturer. CRS must be available for purchase from dealers, in the 3 big Latin NCAP markets (Argentina, Brazil, Mexico). CRS must be available at the 3 most important cities of each of the 3 big markets in at least 2 retailers per city. The CRS manufacturer must be officially represented locally in each one of the 3 big markets.

max. 49 points							
Dynamic assessment			Dummy	Q1½		Q3	
Requirements for Points in Dynamic Assessments: no partial or full ejection of child dummy out of CRS / CRS must not be partially or wholly unrestrained by any of the vehicle interfaces							
Head Contact with the vehicle: any head contact with the vehicle results in 0 points for the head performance							
Frontal Impact (max. 16 points)							
Head			points	4	0	4	0
worst score from	**no head contact with CRS** **head contact with CRS**	no direct evidence + Head a_{res} peak Head a_{res} 3ms	g	< 80 ≤ 72	≥ 88	< 96 ≤ 87	≥ 100
Forward Facing CRS			points	4	0	4	0
	forward head excursion	relative to Cr point	mm	≤ 549	≥ 550	≤ 549	≥ 550
Rearward Facing CRS							
	head exposure	no compressive load on top of head, head fully restrained within CRS	points	4	0	4	0
			points	2	0	2	0
Neck		upper Neck F_z	kN	≤ 1.7	≥ 2.62	≤ 1.7	≥ 2.62
Chest		$a_{res\ 3ms}$	g	≤ 41	≥ 55	≤ 50	≥ 66
Side Impact (max. 8 points)							
Requirements for Points in Side Impact: head containment within shell of CRS, also there must be no fracturing of the CRS							
			points	4	0	4	0
	no head contact with CRS **head contact with CRS**	no direct evidence + Head a_{res} peak Head a_{res} 3ms	g	< 80 ≤ 72	≥ 88	< 80 ≤ 72	≥ 88
Installation of CRS (12)							
CRS from the reference list			points	10			
CRS recommended by the manufacturer			points	2			
Vehicle Based Assessment (max. 13 points)							
provision of three-point seat belts			if any passenger seat is not equipped with a 3 point belt 0 points are awarded for the vehicle based assessment				
compatibility of all passenger seats with Gabarit according to UN ECE R16.05			points	2			
3 seating positions that can simultaneously accommodate any reference list CRS			points	1			
3 seating positions that can simultaneously accommodate i-Size CRS			points	1			
2 passenger seats equipped with ISOFIX according to UN R14			points	1			
+ these 2 passenger seats meet i-Size requirements			points	+1			
2 seating positions comply with requirements for largest size of rearward facing ISOFIX seats			points	1			
no passenger airbag			points	2			
passenger airbag warning and disabling			points	max. 4			
1 integrated CRS			points	1			
1 integrated "Group I-III" CRS			points	1			

Child Occupant Protection Assessment in ASEAN NCAP

COP Protocol Version 1.3

max. 49 points							
Dynamic assessment: Frontal Impact (max. 16 points)			Dummy	Q1½		Q3	
Head			points	4	0	4	0
worst score from	**no head contact with CRS** **head contact with CRS**	no direct evidence + Head a_{res} peak Head a_{res} 3ms	g	< 80 ≤ 72	≥ 88	< 96 ≤ 87	≥ 100
Forward Facing CRS			points	4	0	4	0
	forward head excursion	relative to Cr point	mm	≤ 549	≥ 550	≤ 549	≥ 550
Rearward Facing CRS							
	head exposure	no compressive load on top of head, head fully restrained within CRS	points	4	0	4	0
			points	2	0	2	0
Neck		upper Neck F_z	kN	≤ 1.7	≥ 2.62	≤ 1.7	≥ 2.62
Chest		$a_{res\ 3ms}$	g	≤ 41	≥ 55	≤ 50	≥ 66
Dynamic assessment: Side Impact (max. 8 pt.)							
Head			points	4	0	4	0
	no head contact with CRS **head contact with CRS**	no direct evidence + Head a_{res} peak Head a_{res} 3ms	g	< 80 ≤ 72	≥ 88	< 96 ≤ 72	≥ 88
Installation of CRS (12)							
Vehicle Based Assessment (13)							

more about Latin NCAP ➲ Page 44 & ASEAN NCAP ➲ Page 45

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Passenger Cars in Low-Speed Crashes

Course Description

In addition to the design of car structures for the protection of its occupants at high impact velocities, requirements and test procedures for collisions at low speeds, which massively influence the design of the vehicle front, were brought to the fore in recent years.

For the initial insurance classification of passenger cars classification tests of RCAR / AZT (impact speed up to 15 km/h) are used to determine standardized repair costs. To meet the insurance classification tests, many vehicles are equipped with cross member systems that feature energy absorbing elements (crash boxes), that can be connected via a detachable connection to the longitudinal members in the vehicle front.

Additional partly conflicting requirements are added through the EC Regulation 78/2009/EC and the NCAP tests for pedestrian protection. Compliance with the directive in the leg impact area is usually achieved by energy absorption in conjunction with a targeted support of the impacting leg in the immediate front area of the vehicle.

In connection with the design of vehicles for the different requirements, numerous conflicts occur, which often can only be solved at the expense of a non-optimum front end package or increased weight and manufacturing costs.

Additional requirements regarding the design of the vehicle front result from legislation for vehicle protection (UN R42, ...) and internal testing procedures of the manufacturer for ensuring management of everyday damages for his vehicles.

Course Objectives

In this seminar, you first get an overview on the requirements and regulations which have an impact on the design of cars for the various low-speed crash constellations. This is followed by a presentation of current energy management in the front body structure and an introduction of technical solutions. Based on the state of the art approaches of integral safety are discussed. Using interactive visualization of driving maneuvers, possibilities and limits of safety concepts, using e.g. pre-crash sensors and which could be implemented in the future, are discussed.

Who should attend?

The seminar is aimed at specialists from passenger car and light commercial vehicle development, engineers and technicians from simulation and testing, project engineers and managers who want to get an overview of the requirements and technological solutions for the development of passive and integrated safety systems for passenger cars in low-speed crash.

Course Contents

- Requirements and test procedures for low-speed crash
  - Introduction to the requirements for low-speed crash tests
  - Legal tests
  - Consumer protection tests
  - Other requirements
- Energy management and structural forces in the vehicle front
  - Load paths and structure loading
  - Connections to high-speed test
  - Workshop for analyzing crash data and the impact of structural design changes
  - Changes of structural design
  - Influence of crash sensing and restraint systems
- Design of passive systems
  - Conceptual solution approaches
  - Methods for system design
  - Conflicts of objectives
  - Technological feasibility and limits
- Discussion of integral safety systems
  - Simulation of driving maneuvers and time – distance considerations
  - Potential of integrated solutions
  - Technological feasibility and limits

Instructor

Prof. Dr. Harald Bachem (Ostfalia University of Applied Sciences) has been in charge of teaching and research in vehicle safety at the Ostfalia University of Applied Sciences since 2011. Prior to joining the university he held various management positions in industry where he was in charge of development and testing of vehicle safety functions. His last management position was head of cab body development at MAN Truck & Bus AG. Bachem is chairman of VDI Brunswick and vice chairman of the Wolfsburg Institute for Research, Development and Technology Transfer e.V.

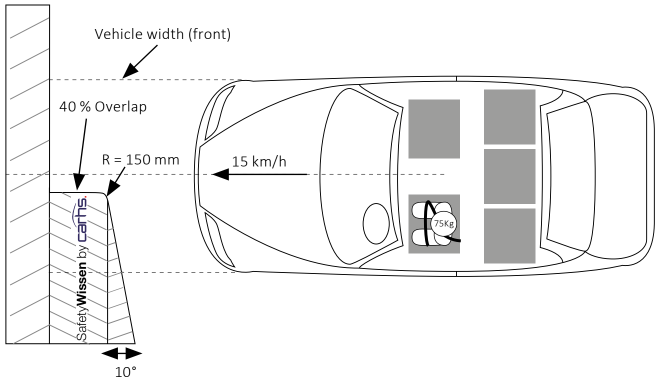
Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
08.03.2017	2815	Alzenau	1 Day	740,- EUR till 08.02.2017, thereafter 890,- EUR	German
18.10.2017	2862	Alzenau	1 Day	740,- EUR till 20.09.2017, thereafter 890,- EUR	German

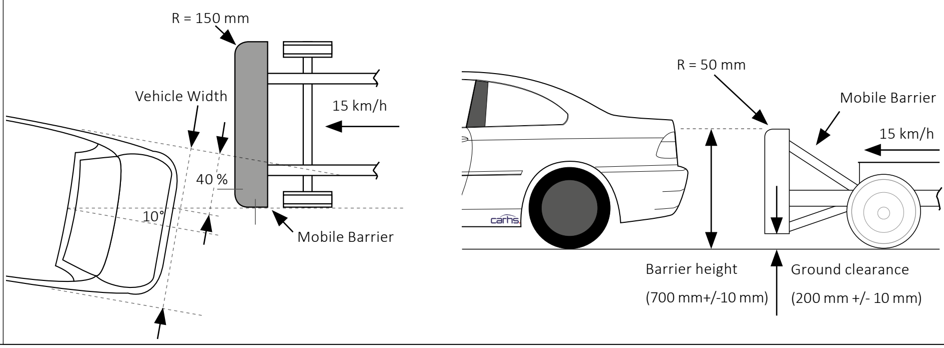
RCAR Insurance Tests

Lowspeed Structural Crash Tests

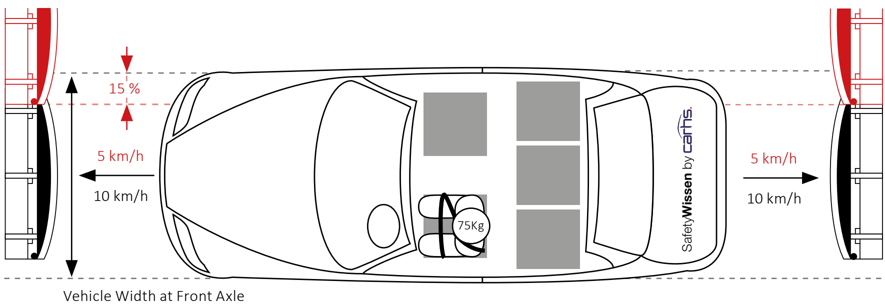
Front



Rear



Bumper Test



Barrier ground clearance measured from the track surface to the lower surface of the bumper barrier:

Test	Ground Clearance	Remarks
Front 100%	$455^{\pm 3}$ mm	
Rear 100 %	$405^{\pm 3}$ mm or $455^{\pm 3}$ mm	EU and Asia (AZT...) 405 mm, USA (IIHS) 455 mm
Front / Rear 15 %	$405^{\pm 3}$ mm or $455^{\pm 3}$ mm	Asia (IAG...) and USA (IIHS) 405 mm

UN ECE Vehicle Classification

Consolidated Resolution on the Construction of Vehicles (R.E.3), Revision 4

Category	Wheels	Engine Capacity	Maximum Design Speed	Unladen Mass	Power	Seats	Maximum Mass
L1	2	≤ 50 cm^3	≤ 50 km/h				
L2	3	≤ 50 cm^3	≤ 50 km/h				
L3	2	> 50 cm^3	> 50 km/h				
L4	3[1]	> 50 cm^3	> 50 km/h				
L5	3[2]	> 50 cm^3	> 50 km/h				
L6	4	≤ 50 cm^3	≤ 45 km/h	≤ 350 kg [3]	≤ 4 kW		
L7	4			≤ 400 kg [3,4]	≤ 15 kW		
M	Vehicles used for the carriage of passengers						
M1	≥ 4					≤ 9	
M2	≥ 4					> 9	≤ 5 t
M3	≥ 4					> 9	> 5 t
N	Vehicles used for the carriage of goods						
N1	≥ 4						≤ 3.5 t
N2	≥ 4						3.5 t < m ≤ 12 t
N3	≥ 4						> 12 t
O	Trailers (including semi-trailers)						
O1							≤ 0.75 t
O2							0.75 t < m ≤ 3.5 t
O3							3.5 t < m ≤ 10 t
O4							> 10 t
T	Agricultural or forestry vehicles						
G	Off-Road vehicles						

[1] asymmetrically arranged in relation to the longitudinal median plane

[2] symmetrically arranged in relation to the longitudinal median plane

[3] not including the mass of the batteries in case of electric vehicles

[4] ≤ 550 kg for vehicles intended for carrying goods

Applicabilty of selected UN Regulations to vehicle categories:

UN R	L1	L2	L3	L4	L5	L6	L7	M1	M2	M3	N1	N2	N3	O1	O2	O3	O4
11								•			•						
12								•			•						
14								•	•	•	•	•	•				
16		•		•	•	•	•	•	•	•	•	•	•	•	•	•	•
17								•	•	•	•	•	•				
21								•									
25		•		•	•	•	•	•	•	•	•	•	•				
32								•									
33								•									
42								•									
94								•									
95								•			•						
127								•			•						
135								•			•						
137								•									

Automotive Safety Summit Shanghai 2017

For the last 3 years **»SafetyTesting China«** has attracted more than 250 participants each year to discuss the latest requirements and innovations in testing of active and passive safety. The newly developed **»Automotive Safety Summit Shanghai«** continues the successful SafetyTesting series and expands the scope of the event to all aspects of automotive safety. Join **»Automotive Safety Summit Shanghai«** on August 1 - 2, 2017 at the Kerry Hotel in Pudong, Shanghai, China.

Keynotes from international experts, presentations on requirements and innovations, the latest developments in testing and simulation for active and passive systems will make this event a true highlight for every decision maker and engineer in the fields of active and passive safety. With the rapid rise of New Energy Vehicles (EV, PHEV and FCV), new challenges are surfacing for the safety community. The **»Automotive Safety Summit Shanghai«** is setting a focal point on **Safety of New Energy Vehicles**, discussing requirements, technologies and validation aspects for safety of NEVs.

The event will have dedicated sessions on the following topics.

- Safety of New Energy Vehicles
- Global Legal and Consumer Requirements
- Pedestrian Safety
- Autonomous Emergency Braking
- Safety Testing and Simulation
- Safety in Autonomous Driving

A special session will be dedicated to Start-Ups in automotive Safety, featuring young companies with highly innovative ideas.

Who should attend?

»Automotive Safety Summit Shanghai« is addressing decision makers and engineers at all stages of the development phase, managers during the conceptual phase who need to understand upcoming global requirements, design engineers, testing and simulation specialists.

Facts

DATE	01.-02. August 2017
HOMEPAGE	www.carhs.de/safetysummit
VENUE	Kerry Hotel, Pudong, Shanghai, China
LANGUAGE	English / Chinese with simultaneous translation

Introduction to Data Acquisition in Safety Testing

Course Description

Sensor technology and data acquisition are central elements of safety testing. A 100 % reliability of the used technology in combination with the highest accuracy of the employed sensors are the basis for the success and usefulness of the tests in vehicle development.

The course first presents a short overview on the historical development of data acquisition technology in the safety field and continues by going into details of current technologies of sensors, data acquisition as well as dummy and vehicle instrumentation.

Based on the procedures of a safety test, the different tasks of calibration and certification of sensors, filtering and evaluation of signals, as well as the calculation and evaluation of measurement errors will be explained.

The course provides the basic knowledge in crash data acquisition and gives a comprehensive overview on the procedures employed in data acquisition in the crash testing environment.

Course Objectives

The course participants will learn about the technology and terminology of sensor and data acquisition technology used in safety testing. They will be qualified to define tests, to supervise tests and to interpret and evaluate test results.

Who should attend?

This introductory course aims at new test engineers and project engineers as well as engineers from simulation departments at automotive OEMs, suppliers and engineering service providers.

Course Contents

- Sensors
  - Basic sensor principles
  - Sensors in safety testing
  - Selection of sensor systems
- Systems for data acquisition (DAS)
  - State of the art in DAS technology
  - InDummy and Onboard DAS
  - Filtering
- Instrumentation
  - Overview dummy instrumentation
  - Overview vehicle instrumentation
  - Overview instrumented barriers
- Evaluation & Measuring Errors
  - Error calculation (set-up of sensors, sensors, DAS, evaluation...)
  - Sources of errors in crash testing
  - Interpretation of signals
- Calibration and Certification
  - Dummy certification
  - Sensor calibration
  - SAE J211
- Procedures
  - Test preparation
  - Test execution
  - Test evaluation

Instructor

Thomas Wild (Continental Safety Engineering International GmbH) studied Electrical and Tele-Communications Engineering at the Technical University Darmstadt. Since 1996 he has been employed at Continental Safety Engineering International as a measurement engineer. 1998 - 2001, he assumed additional responsibilities as an application engineer in the algorithm development. Since 2003 he is team leader measurement and video technology. Since 1997 he works in the working group Data Processing in Vehicle Safety (MDVFS).

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
27.-28.04.2017	2929	Alzenau	2 Days	1.290,- EUR till 30.03.2017, thereafter 1.540,- EUR	German
19.-20.10.2017	2930	Alzenau	2 Days	1.290,- EUR till 21.09.2017, thereafter 1.540,- EUR	German

Current Dummy Landscape

Region	Dummies	Frontal Impact: HIII 50 %	Frontal Impact: HIII 5 %	Frontal Impact: HIII 95 %	Frontal Impact: THOR 50 %	Side Impact: ES-2	Side Impact: ES-2re	Side Impact: SID-IIs	Side Impact: World SID	Rear Impact: HIII 50 %	Rear Impact: BioRID II	Child: Crabi	Child: Cami	Child: HIII	Child: P Series	Child: Q Series
Europe	UN R94	●														
	UN R95					●										
	UN R44														●	○
	UN R129															●
	UN R135								●							
	UN R137	● (2018)	● (2018)													
	Euro NCAP	●	●	(●)	● (2020)				●		●					●
America	FMVSS 208	●	●									●		●		
	FMVSS 214						●	●	○							
	FMVSS 213											●	●	●	●	○
	FMVSS 202a									●						
	FMVSS xxx (OMDB)				○											
	U.S. NCAP	●	●		● (2018)		●	●	● (2018)							
	IIHS	●						●			●					
	Latin NCAP	●				●										●
Asia	Japan Regulations	●				●										
	JNCAP	●	●			●					●					
	China Regulations	●				●										
	China NCAP	●	●			●		●	● (2018)		●				●	● (2018)
	Korean NCAP	●	●						●		●					●
	ASEAN NCAP	●				●										●
AUS	ADR (Frontal, Side)	●				●			●							
	Australian NCAP	●	● (2018)			●			● (2018)		●				●	●
GTR	GTR 7	●									●					
	GTR 14 (Pole Side)								●							

2017 2018 2019 2020 ○ = planned, no date specified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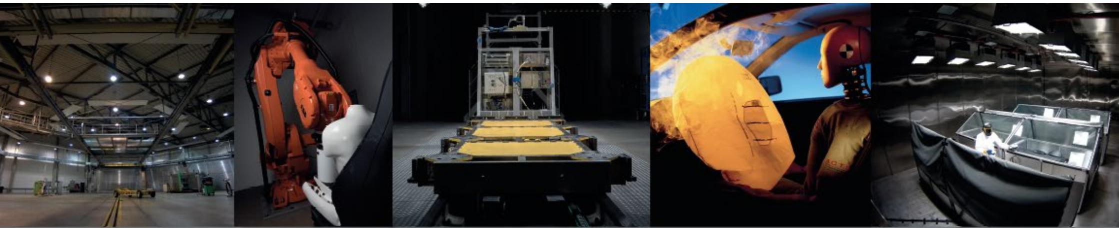
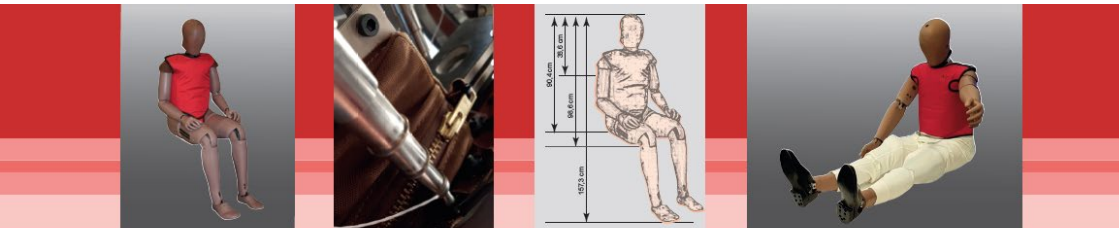
THOR 50 % Male: Injury Criteria and Risk Functions

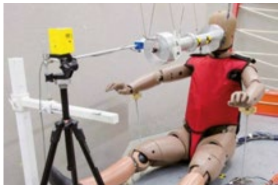
Region	Criterion	Calculation	Risk Function
Head	HIC_{15} (-)	$\left[(t_2-t_1)\left[\frac{1}{(t_2-t_1)}\int_{t_1}^{t_2} a(t)dt\right]^{2.5}\right]_{max}$	$p(AIS\geq 3)=\Phi\left[\frac{\ln(HIC_{15})-7.45231}{0.73998}\right]$
	Brain Injury Criterion BrIC (-)	$\sqrt{\left(\frac{\max(\lvert\omega_x\rvert)}{\omega_{xC}}\right)^2+\left(\frac{\max(\lvert\omega_y\rvert)}{\omega_{yC}}\right)^2+\left(\frac{\max(\lvert\omega_z\rvert)}{\omega_{zC}}\right)^2}$ with $\omega_{[x,y,z]}$ = Angular velocity (rad/s) ω_{xC} = 66.25 rad/s ω_{yC} = 56.45 rad/s ω_{zC} = 42.87 rad/s	$p(AIS\geq 3)=1-e^{-\left(\frac{BrIC}{0.987}\right)^{2.84}}$
Neck	N_{ij} (-)	$\frac{F_z}{F_{zc}}+\frac{M_y}{M_{yc}}$ with F_{ZC} = 2520 N/-3640 N (tension/compression) M_{YC} = 48 Nm/-72 Nm (flexion/extension)	$p(AIS\geq 3)=\frac{1}{1+e^{3.227-1.969N_{ij}}}$
Chest	Multi-point Thoracic Injury Criterion R_{max} (mm)	$max(UL_{max},UR_{max},LL_{max},LR_{max})$ with $[U/L\lvert R/L]_{max}$ $= max\left(\sqrt{[L/R]X^2_{[U/L]S}+[L/R]Y^2_{[U/L]S}+[L/R]Z^2_{[U/L]S}}\right)$ $[L/R][X/Y/Z]^2_{[U/L]S}$: Time-History of the [left/right] chest deflection along the [x/y/z] axis relative to the [upper/lower] spine segment	$P(AIS\geq 3\lvert\, age,R_{max})$ $=1-exp\left(-\left[\frac{R_{max}}{exp(4.4853-0.0113age)}\right]^{5.03896}\right)$
Abdomen	Compression A_{max} (mm)	$\frac{\max(\delta L,\delta R)}{d_{abd}}$, with δ[L/R]: Peak X-axis deflection of the [left / right] abdomen d_{abd} = 238.4 mm	$p(AIS\geq 3)=1-e^{-\left(\frac{A_{max}}{0.4247}\right)^{3.6719}}$
Pelvis	res. Actetabulum Load F_R (kN)	$\sqrt{F_x{}^2+F_y{}^2+F_z{}^2}$	$p(AIS\geq 3)=\Phi\left[\frac{\ln(F_R/0.72)-1.6526}{0.1991}\right]$
Femur	Axial Load F_Z (kN)	-	$p(AIS\geq 2)=\frac{1}{1+e^{5.7949-0.5196F_z}}$
Tibia	Revised Tibia Index RTI (-)	$\frac{F}{F_c}+\frac{M}{M_c}$, with F_C = 12 kN M_C = 240 Nm	$p(AIS\geq 2)=1-exp\left(-exp\left[\frac{ln(RTI)-0.2468}{0.2728}\right]\right)$
	$F_{Z,upper}$ (kN)	-	$p(AIS\geq 2)=\frac{1}{1+e^{5.6654-0.8189F_z}}$
	$F_{Z,lower}$ (kN)	-	$p(AIS\geq 2)=\frac{1}{1+e^{4.572-0.670F_z}}$
Foot	$M_{Y,ankle}$ (Nm)	$M_Y-F_xD-\frac{ma_xD}{2}$, with M_Y(Nm), F_X(N) of the lower tibia load cell a_X(m/s²) of the tibia D = 0.0907 m m = 0.72 kg	$p(AIS\geq 2)=\frac{1}{1+e^{6.535-0.1085M_y}}$
	$M_{Z,ankle}$ (Nm)	$M_x-F_yD-\frac{ma_yD}{2}$, with M_X(Nm), F_Y(N) of the lower tibia load cell a_Y(m/s²) of the tibia D = 0.0907 m m = 0.72 kg	$p(AIS\geq 2)=\Phi\left[\frac{M_x-40Nm}{10Nm}\right]$

Source: Saunders, Parent, Ames; NHTSA OBLIQUE CRASH TEST RESULTS: VEHICLE PERFORMANCE AND OCCUPANT INJURY RISK ASSESSMENT IN VEHICLES WITH SMALL OVERLAP COUNTERMEASURES; ESV 2015; Paper Number: 15-0108



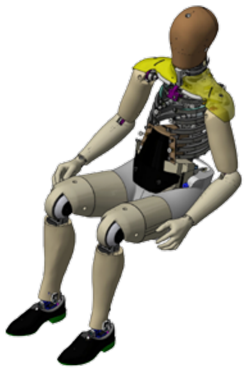


Praxis Conference Crash Dummy



A new generation of crash test dummies is entering the market. THOR, World SID and Q-Dummies replace older dummy models. This brings some challenges:

- The new dummies require significant adaptations of restraint system, vehicle interiors and vehicle structures.
- The calibration and certification of the new dummies is much more demanding for the laboratories.
- The handling of the new and more complex dummies with their digital instrumentation and new sensors require entirely new processes and intensive training of the technical staff.
- Validated and robust CAE models of the new dummies are required to perform meaningful and reliable simulations.



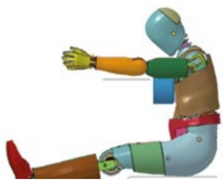
The new PraxisConference Crash Dummy, jointly organized by BGS Böhme & Gehring and carhs.training, is dedicated to these issues. It brings together users and developers, and sees itself as a communication platform for experts.

A highlight of the event is the hands-on praxis session in the laboratory of the German Federal Highway Research Institute (BASt) where topics such as dummy seating, calibration, measurement, mounting and handling are shown in practice and attendees can gain hands-on experience.

Who should attend?

The PraxisConference is aimed at everyone who has to deal with the new dummy generations:

- Technicians from crash test, sled test or dummy labs
- Simulation engineers
- Developers of restraint systems, interior components or vehicle structures
- Developers of dummies and dummy simulation models who want to get in touch with users



Facts

DATE	11.- 12. October 2017
HOMEPAGE	www.carhs.de/pkcd
VENUE	Bundesanstalt für Straßenwesen, Brüderstraße 53, 51427 Bergisch Gladbach
LANGUAGE	German with simultaneous translation into English
PRICE	1.450,- EUR till 13.09.2017, thereafter 1.690,- EUR

Co-hosted with

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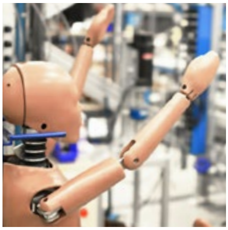
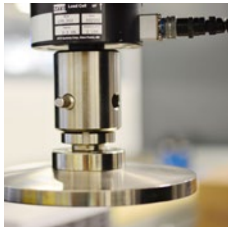
Test
Process

Test
Service

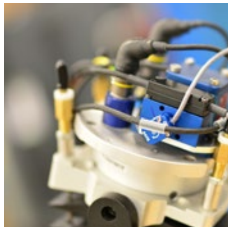

Service & Support


Adult ATDs

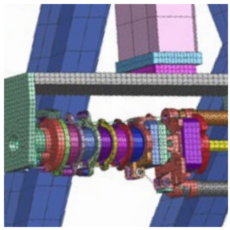

Child ATDs


Load Cells


Test Fixtures


DAS Integration


Pedestrain Testing


FEA Models

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Overview Dummies
Weights, Dimensions and Instructions for Calibration

Adult Dummies for Frontal / Rear Impact

	Weight (kg)	Seating Height (cm)	Instruction for Calibration
Hybrid II 50 % Male	74.4	90.7	CFR 49 Part 572, Subpart B
Hybrid III 5 % Female	49.1	78.7	SAE Engineering Aid 25 CRF 49 Part 572, Subpart O
Hybrid III 50 % Male	77.7	88.4	CFR 49 Part 572, Subpart E 1999/98/EG
Hybrid III 95 % Male	101.2	93.5	SAE Engineering Aid 26
BioRID II	77.7	88.4	User Manual

Adult Dummies for Side Impact

	Weight (kg)	Seating Height (cm)	Instruction for Calibration
Eurosid 1	72.0	90.4	Eurosid 1 Certification Procedure 96/27/EG, UN R95
ES-2	72.0	90.9	FTSS- User Manual / UN R95
ES-2 re	72.0	90.9	CFR 49 Part 572, Subpart U
US-SID	76.7	89.9	CFR 49 Part 572, Subpart F
US-SID/Sid-H3	77.2	89.9	CFR 49 Part 572, Subpart M
SID IIs	44.5	79.0	CFR 49 Part 572, Subpart V
WorldSID 5 % Female	48.27		User Manual
WorldSID 50 % Male	74.88	87.0	User Manual

Child Dummies

	Weight (kg)	Seating Height (cm)	Instruction for Calibration
P0, P¾, P6, P10	3.4- 32.0	34.5- 72.5	User Manual
P3	15.0	56.0	User Manual
P1½	11.0	49.5	P1½ User Manual
Q1	9.6	47.9	Q1 User Manual
Q1½ (18m)	11.1	49.9	Q1,5 User Manual
Q3	14.5	54.4	Q3 User Manual
Q6	23.0	63.6	Q6 User Manual
Q10	35.5	73.4	Q10 User Manual (Rev. A Draft)
CRABI 12m	10.0	46.4	CFR 49 Part 572, Subpart R
Hybrid II - 3 y/o	15.1	57.2	CFR 49 Part 572, Subpart C
Hybrid II - 6 y/o	21.5	64.5	CFR 49 Part 572, Subpart I
Hybrid III - 3 y/o	16.7	54.6	CFR 49 Part 572, Subpart P
Hybrid III - 6 y/o	23.4	63.5	CFR 49 Part 572, Subpart N
Hybrid III - 10 y/o	35.2	72.39	CFR 49 Part 572, Subpart T

Dummy – Trainings

Course Description

The seminars give you the opportunity to gain efficiency and security in the use and handling of dummies.
After a short theoretical introduction you are going to be trained in the handling of the respective dummy-type in a dummy lab in practical exercises in work groups.

Course Contents

- Introduction of the respective dummy-type
  History, development, assemblies, standard instruments, optional measuring points, recent modifications, regulations for application/test, calibration
- Complete disassembly of the dummies in work groups
  Explanation of the functions of the assemblies and the individual parts, special features, deviations from other dummy-types, practical hints for the handling of individual assemblies, sensors and cabling, special tools, other devices, cleaning
- Complete assembly of the dummies in work groups
  work steps, possible assembly errors, mounting of the sensors, cabling, adjustments of joints, storing/transport
- Dummy calibration
  Demonstration and explanation of the calibration tests

Course Objectives

- Efficiency and security in use and handling of dummies
- Exact knowledge about assembly, mechanics and sensor positions
- Understanding of the measuring possibilities and limits

Who should attend?

- Project and test engineers, technicians, mechanics



DUMMY	Hybrid III 5%, 50%, 95%	
DATE	09.-10.02.17	25.-26.09.17
COURSE ID	2961	2962
PRICE	1.290,- EUR (each)	
DUMMY	THOR	
DATE	27.-28.03.17	04.-05.12.17
COURSE ID	2977	2978
PRICE	1.490,- EUR (each)	
DUMMY	BioRID II	
DATE	15.-16.02.17	17.-18.10.17
COURSE ID	2965	2966
PRICE	1.290,- EUR (each)	
DUMMY	WorldSID 50%	
DATE	20.-21.03.17	27.-28.11.17
COURSE ID	2975	2976
PRICE	1.490,- EUR (each)	
DUMMY	ES-2 / ES-2re	
DATE	07.-08.03.17	14.-15.11.17
COURSE ID	2971	2972
PRICE	1.290,- EUR (each)	
DUMMY	SID IIs	
DATE	14.-15.03.17	21.-22.11.17
COURSE ID	2973	2974
PRICE	1.290,- EUR (each)	
DUMMY	P-/Q-Child Dummys	
DATE	20.02.17	07.11.17
COURSE ID	2967	2968
PRICE	740,- EUR (each)	
DUMMY	Q6 / Q10	
DATE	21.02.17	08.11.17
COURSE ID	2969	2970
PRICE	740,- EUR (each)	
DUMMY	Hybrid III 3 & 6 y/o	
DATE	13.02.17	27.09.17
COURSE ID	2963	2964
PRICE	740,- EUR (each)	
VENUE	Bergisch Gladbach	
LANGUAGE		

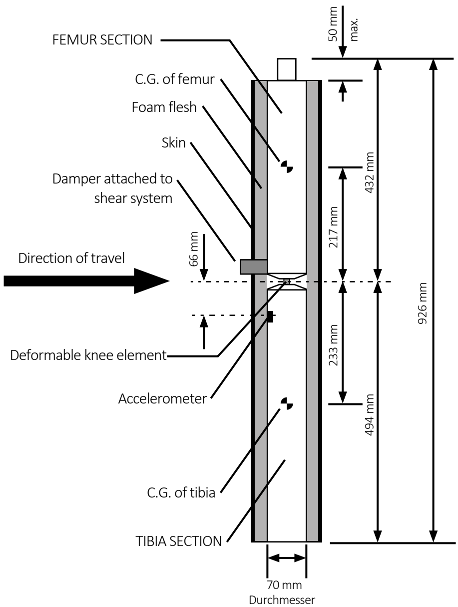
Instructors

Dummy Specialists, BGS Böhme & Gehring GmbH

BGS operates the dummy calibration laboratory of the German Federal Highway Research Institute (BASt). BGS calibrates crash test dummies for the automotive industry. The seminars are held by experienced engineers from BGS' team.

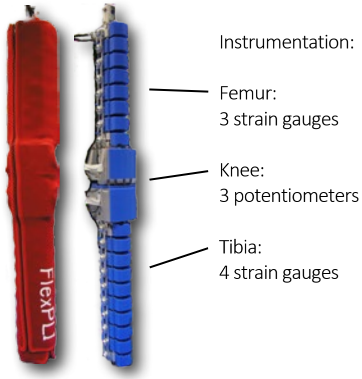
Impactors for Pedestrian Protection

Lower Legform (EEVC)



Length	Diameter	Mass
926 mm	ca. 132 mm	13.4 kg

Flexible Pedestrian Legform Impactor: Flex PLI

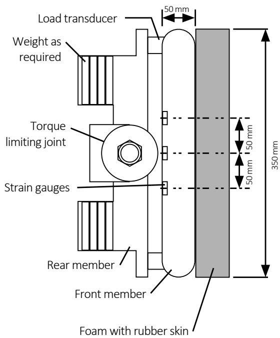


Proposed criteria and limits for Flex PLI:

Criterion	Limit
Tibia bending Moment	340 Nm (380 Nm in exception zone)
MCL Elongation	22 mm
ACL / PCL Elongation	13 mm

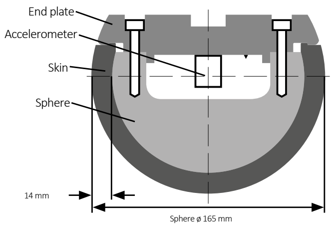
Length	Diameter	Mass
975 mm	132-140 mm	13.4 kg

Upper Legform



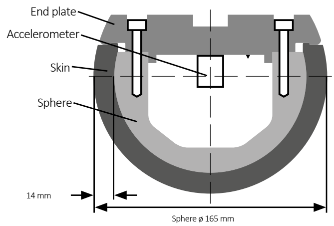
Length	Width	Mass
350 mm	ca. 155 mm	11 - 18 kg

Adult Headform Impactor



	Diameter	Mass
Adult Headform	165 mm	4.5 kg

Child Headform Impactor



SafetyWissen by carhs.

	Diameter	Mass
Child Headform	165 mm	3.5 kg

more on pedestrian protection ➲ page 78

Pedestrian Protection - Test Procedures

Course Description

A basic prerequisite for successful implementation of pedestrian protection is a detailed knowledge of test requirements. This seminar provides the complete knowledge regarding the test methods as defined by the EU Directive on pedestrian protection and Euro NCAP's pedestrian protection assessment in theory and praxis.

Compact presentations explain the basics and technical details of the regulation and the test protocols. Practical exercises the BASt's test laboratory include test preparation, vehicle marking, selection of test points, handling of the impactors and the actual testing with head and legform impactors.

Course Contents

- Basics and current status of the regulations (presentations)
- Euro NCAP - Rating (presentation)
- Test preparation according to Euro NCAP Testing Protocol and EU Directives (practical exercises)
- Test demonstrations: Head, Upper Legform and Legform impact (demonstrations and practical exercises)
- Discussion

Who should attend?

- Project-, test- and simulation engineers,
- Technicians, mechanics

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
25.-27.04.2017	2993	Bergisch Gladbach	3 Days	1.790,- EUR	German
19.-21.09.2017	2994	Bergisch Gladbach	3 Days	1.790,- EUR	German

Pedestrian Protection Workshop: Flex PLI

Course Objectives

- Detailed Knowledge of the new Impactor
- Experience with Handling and Usage of the Impactor
- Understanding of the Impactor's Functionality

Course Contents

- History, Biomechanics, Evaluation, Legislation
- Assembly, Transducers, Onboard Data Acquisition, Technical Details
- Disassembly along with Comments on Function of Components
- Assembly along with practical Tips and Pointers to Specialities and possible Mistakes
- Adjustments of the Compound Springs, Clamping Bolts, Stopper Cables, etc.
- Demonstration of both Certification Procedures
- Data Analysis and Interpretation of Test Results

Who should attend?

- Project-, test- and simulation engineers,
- Technicians, mechanics

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
06.04.2017	2999	Bergisch Gladbach	1 Day	740,- EUR	German
14.09.2017	3000	Bergisch Gladbach	1 Day	740,- EUR	German

Pedestrian Protection Workshop: Test Areas and Test Points

Course Objectives

- Experience with the new Vehicle Markup
- Certainty in its Application
- Deep Understanding of the Procedure

Course Contents

- Basics, Background and Development of the Procedure
- Test Area Determination, Borders, Exemption Zones, Special Cases
- Necessary Laboratory Equipment, Helpful Tools
- Exemplification by a complete Mark-up of a Vehicle
- Color Scheme, Manufacturers Predictions, allowed Tolerances
- Default Green / Default Red Definitions
- Result Analysis, Point Assessment
- Adaption of the Principle to Upper- and Lowerleg Areas

Who should attend?

- Project-, test- and simulation engineers,
- Technicians, mechanics

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
05.04.2017	2997	Bergisch Gladbach	1 Day	740,- EUR	German
13.09.2017	2998	Bergisch Gladbach	1 Day	740,- EUR	German

Introduction to Active Safety of Vehicles

Course Description

Increasing demands on the protection of vehicle occupants have led to a continuous reduction in the number of injured and killed persons. While more than 20,000 persons have been killed on German roads in the early 1970s, this number is now well below 4,000. Passive safety, i. e. measures which are designed to minimize the consequences of an accident, has made a significant contribution to this achievement.

While the potential of passive safety is considered to be largely exhausted and huge efforts are required to achieve further progress in occupant protection, active safety has become increasingly important in recent years. Active Safety means measures which prevent an accident or at least reduce the collision speed and thus the energy input.

While technologies such as ABS or ESP have been established years ago and have proven their effectiveness, new techniques such as the emergency brake or the lane keeping assist and numerous other driver assistance systems are just entering the market. It can be assumed that these systems will be widely used in the next few years and will lead to a further decrease in the number of traffic victims.

Automated driving can be seen as the next step of active safety. Although there is still a lot of development needed in this area, it can be assumed that vehicles which will driven at least partially automatically in certain traffic scenarios will enter the market over the next ten years.

In the seminar first a brief introduction to active safety, in contrast to passive safety is given. This is followed by a presentation of current active safety systems and an overview of the requirements of legislation and consumer protection organizations. In addition, current and upcoming developments in the area of driver assistance systems and automated driving are presented.

Who should attend?

The seminar is aimed at new and experienced engineers working in the field of active vehicle safety in research and development departments of automotive OEMs or suppliers, as well as for all other interested parties, which want to receive an overview of current and future developments in the areas of active vehicle safety, driver assistance and automated driving.

Course Contents

- Fundamentals of active safety
  - Basic principles of action
  - Legal requirements
  - Euro NCAP requirements
- Current active safety systems
  - ABS
  - ESC
  - Brake assist
  - Pre-crash systems
- Driver assistance systems
  - Basic requirements and design strategies
  - Current and future driver assistance systems
- Automated driving
  - State of the art
  - Opportunities and risks
  - Human machine interface
  - Market introduction strategies

Instructor

Dr. Gerd Müller (Technical University of Berlin) has been working at the department automotive technology of the Technical University of Berlin since 2007. From 2007 to 2015 he was a research assistant. Since 2015 he has been a senior engineer of the same department. His research focuses on vehicle safety and friction coefficient estimation. Dr. Müller gives the lecture "Fundamentals of Automotive Engineering" and conducts parts of the integrated course "Driver Assistance Systems and Active Safety".

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
08.05.2017	2944	Alzenau	1 Day	740,- EUR till 10.04.2017, thereafter 890,- EUR	
17.11.2017	2945	Alzenau	1 Day	740,- EUR till 20.10.2017, thereafter 890,- EUR	

NCAP Tests for Active Safety and Driver Assistance

Euro NCAP

Safety Assist Assessment based on:

- Seat Belt Reminder (SBR):
  - On all front row seats 2 Points
  - additionally on all rear seats 1 Point
- Speed Assist Systems (SAS)

		SLIF Speed Limit Information Function	MSA Manual Speed Assistance	ISA Intelligent Speed Assistance
Communicating Speed Limit	Subsign recognition (conditional speed limits):			
camera based	no	0.25 Points		0.25 Points
	yes	0.5 Points		0.5 Points
map based	no	0.25 Points		0.25 Points
	yes	0.5 Points		0.5 Points
combined	no	0.75 Points		0.75 Points
	yes	1 Point		1 Point
Warning Function			0.5 Points	1 Points
Speed Limitation	precision -10/+0 km/h		0.75 Points	0.75 Points
	precision -5/+0 km/h		1 Point	1 Point

In total, max. **3 points** are available for Speed Asssist Systems

- Lane Support Systems (LSS):
  - Vehicle under Test (VUT) leaves straight line path in a turn with 1200 m radius followed by a straight line path
  - Test speed 72 km/h
  - LDW Systems: **1.5 Points**
    - lane marking: single dashed line / solid line
    - lateral velocities 0.1 & 0.3 m/s
    - Assessment criterion: Warning must occur at Distance to Line Crossing (DTLC) ≤ -0.3 m
  - LKA Systems: **1 Point**
    - lane marking: solid line
    - lateral velocities 0.1 - 1.0 m/s in 0.1 m/s steps
    - Assessment criterion: Distance to Line Crossing (DTLC) ≤ -0.4 m in 3 out of 5 tests at lateral velocities between 0.1 - 0.5 m/s
  - HMI: Default ON (0.2 Points), Haptic/supplementary warning (0.2 Points), Blind Spot Monitoring (0.1 Points): Total: **0.5 Points**
- AEB Inter-Urban: **max. 3 Points** more ➲ page 126
- AEB City: **max. 3 Points (as part of the Adult Occupant assessment)** more ➲ page 120
- AEB VRU Pedestrian: **max. 6 Points (as part of the Pedestrian Protection assessment)** more ➲ page 122
- Planned extensions:
  - additional scenarios for AEB City / AEB Inter-Urban (starting 2018): Variation of impact point / angle
  - Extension of the Lane Support Systems assessement in the areas “Run Off Road / Road Edge Detection (starting 2018). Higher total score available: 4 Points.
  - AEB VRU Cyclist (as of 2018): max. 6 Points (as part of the Pedestrian Protection assessment)
  - Junction Assist (as of 2020)

Latin NCAP

- Seat Belt Reminder compliant with FMVSS 208 as a prerequisite for 3 or more stars
- ABS as a prerequisite for 3 or more stars
- ESC compliant with GTR 8 as a prerequisite for 4 or more stars more ➲ page 44

ASEAN NCAP

Safety Assist Technology (SAT) Assessment

(Weighting: 25 % of the overall rating)

- Effective Braking & Avoidance (EBA): ABS / ESC: **8 Points**
- Seat Belt Reminder Driver / Passenger (with seat occupancy detector) / rear seats: **6 Points**
- Blind Spot Technology: **2 Points**
- Advanced SAT: AEB, LKA, LDW, FCW etc.: **2 Points**

more ➲ page 45

NCAP Tests for Active Safety and Driver Assistance

U.S. NCAP

planned for 2018 (MY 2019):

Crash Avoidance Rating consisting of

- Forward Collision Warning: **12 Points** more ➲ Page 130
- Crash Imminent Braking: **12 Points** more ➲ Page 130
- Dynamic Brake Support: **11 Points**
- Low Beam Headlighting: **15 Points**
- Semi-automatic headlight beam switching: **9 Points**
- Amber rear turn signal: **6 Points**
- Lane Departure Warning: **7 Points**
- Blind Spot Detection: **8 Points**
- Assessment of the risk for rollover (Static Stability Factor SSF): **20 Points**

additionally as part of the pedestrian safety assessment:

- AEB Pedestrian
- Rear Auto Braking more ➲ Page 128

Crash Avoidance Rating (as of 2018)	
Stars	**required points (out of 100)**
★★★★★	**80**
★★★★	**60**
★★★	**40**
★★	**20**
★	**0**

IIHS

- AEB (part of the Top Safety Pick rating) more ➲ Page 37
  - approach to standing vehicle at 20 km/h and 40 km/h
  - assessment of the speed reduction:

	20 km/h Test			40 km/h Test			
Speed reduction	< 8 km/h	8-14 km/h	≥ 15 km/h	< 8 km/h	8-14 km/h	15- 34 km/h	≥ 35 km/h
Points	0	1	2	0	1	2	3

  - 1 additional point for FCW (Forward Collision Warning) meeting the U.S. NCAP criteria
  - Rating scheme:

Points			
Rating	BASIC	ADVANCED	SUPERIOR

- Advanced Lighting (part of the Top Safety Pick rating)
  - Assessment of the illumination and glare of high and low beam headlights in various test scenarios. Additional credit is given for systems that automatically switch between high and low beam.

JNCAP

- SBR: **8 Points** more ➲ Page 50
- Advanced Safety Award, consisting of:
  - AEB (similar to Euro NCAP AEB Inter-Urban, max 60 km/h without CCRb scenario): max. **32 Points**
  - AEB Pedestrian (day time): max. **25 Points**
  - LDW (at 60 and 70 km/h) : max. **8 Points**
  - Rear View Monitor: max. **6 Points**
  - ASV+ Award for cars achieving **> 12 Points**
  - ASV++ Award for cars achieving **> 46 Points**

KNCAP

- Rollover assessment based on SSF like in U.S. NCAP: **5 Points**
- Braking Performance Tests: Measurement of the stopping distance from 100 km/h on dry and wet road. Check if vehicle stays within the 3.5 m wide track while braking: **5 Points**
- Basic Active Devices:
  - FCWS, LDWS, SLD, SBR front, SBR rear: **0.5 Points each**
  - AEB Inter-Urban: **1 Points**
  - AEB City: **1.5 Points**
- Additional Active Devices (optional): Max. total points for Additional Active Devices = **2 Points**
  - ASCC, BSD, RCTA, LKAS, ISA: **0.5 Points each**
  - AEB Pedestrian, Advanced Airbag: **1 Point each**

more ➲ Page 52

C-NCAP

Active Safety Assessment planned as of 2018 (Weighting: 15 % of the overall rating): more ➲ Page 54

- ESC: **4 Points**
- AEB/FCW Car to Car Rear: **8 Points**
- AEB Pedestrian: **3 Points**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Bat: mammal of the order Chiroptera (/kaɪˈrɒptərə/; from the Greek χείρ - cheir, “hand” and πτερόν - pteron, “wing”). Bats use sensory techniques like echolocation, smell, hearing and the ability to detect ultraviolet light to detect, localize, and classify prey while avoiding collisions with other bats.
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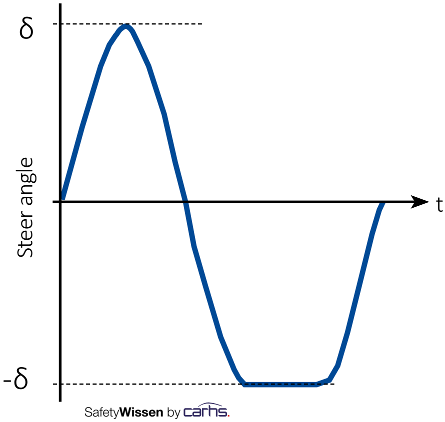
Test of ESC Systems in UN R13H (R140), GTR 8 and FMVSS 126

Step 1: Slowly-Increasing-Steer Manoeuvre to determine parameter A

At a constant velocity of 80±2 km/h the steering angle is ramped at 13.5 deg/s until a lateral acceleration of 0.5 g is reached. Out of 2 series (1x left turn / 1x right turn) with 3 repetitions of the manoeuvre the steering angle A (in degrees) at which the lateral acceleration is 0.3 g is determined using linear regression.

Step 2: Sine with Dwell Manoeuvre to assess Oversteer Intervention and Responsiveness

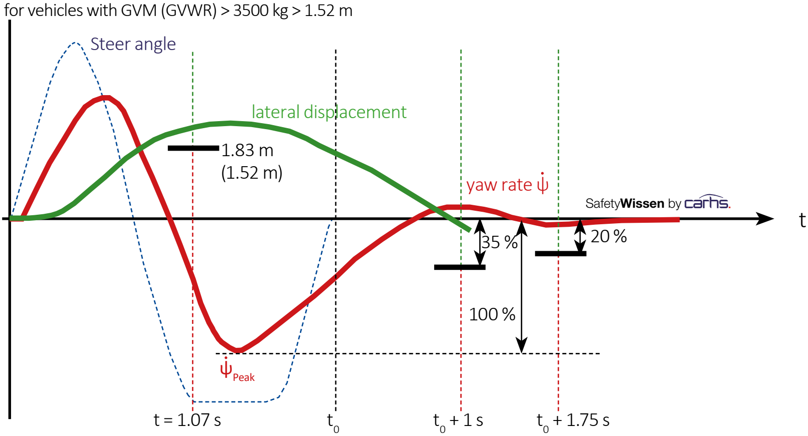
At a velocity of von 80±2 km/h the vehicle is subjected to two series of test runs using a steering pattern of a sine wave at 0.7 Hz frequency with a 500 ms delay beginning at the second peak amplitude:



One series uses counterclockwise steering for the first half cycle, and the other series uses clockwise steering for the first half cycle. In each series of test runs, the steering amplitude is increased from run to run, by 0.5 A, starting at 1.5 A. The steering amplitude of the final run in each series is the greater of 6.5 A or 270 degrees, provided the calculated magnitude of 6.5 A is less than or equal to 300 degrees. If any 0.5 A increment, up to 6.5 A, is greater than 300 degrees, the steering amplitude of the final run is 300 degrees.

Performance Requirements:

- Yaw Rate
  - 1 s after completion of the steering input (t_0) < 35 % of the first peak value of yaw rate recorded after the steering wheel angle changes sign.
  - 1.75 s after completion of the steering input (t_0) < 20 % of the first peak value of yaw rate recorded after the steering wheel angle changes sign.
- Lateral displacement of the vehicle center of gravity with respect to its initial straight path when computed 1.07 seconds after the Beginning of Steer (BOS)
  - for vehicles with GVM (GVWR) ≤ 3500 kg > 1.83 m
  - for vehicles with GVM (GVWR) > 3500 kg > 1.52 m



Autonomous Driving, Advanced Driver Assistance, and Accident Avoidance: Technologies, Scenarios, Legislation, Challenges

Course Description

With the increasing market penetration of Advanced Driver Assistance Systems (ADAS), some of the latest car models offer automated driving in specific traffic scenarios. These partially automated systems, however, must be supervised permanently by the driver. Highly automated systems where the driver must take-over the vehicle control only on request, are expected already in the near future, with the focus on automated driving in traffic jams and on the highway. While the regulatory framework is aborning, major need for action is the so-called backend providing not only highly accurate and actual digital map data, rather the release of the autopilot on specific routes and information about eventual hazards.

In addition to these autopilots in series production vehicles enabling temporarily autonomous driving in specific traffic scenarios under certain circumstances, IT companies, Google first and foremost, as well as carpool services such as Uber, are developing and testing driverless cars. Even some OEMs (Volvo, Ford) have announced to develop self-driving cars for passenger transportation like taxis or shuttle busses. Due to the enormous cost savings by eliminating the driver, significantly more expensive and increasingly powerful technologies can be used in these vehicles, i.e. a 360° high-resolution laser-scanner.

An essential objective of autonomous driving is the reduction and avoidance of accidents. Based on accident analysis, the potential to this effect, both of ADAS and autopilots, is estimated, including the remaining or insufficiently addressed gaps.

The seminar describes and explains in detail the existing and anticipated ADAS, autopilots and accident avoidance systems with a specific focus on the sensors, communication systems and algorithms used, such as artificial intelligence. In particular, the leap from partial to high automation is highlighted, including the technical gaps, the system boundaries, the requirements of functional safety and system validation are discussed. Furthermore, the potential impact on occupant protection systems along with synergies between active and passive safety are touched. Particularly challenging is the re-transition of the vehicle control from the autopilot to the driver. In this context, the importance of the human-machine interface (HMI) along with driver monitoring systems are illustrated. Last, but not least, the legal challenges to automated driving are highlighted, the vehicle certification requirements in particular.

Who should attend?

This seminar offers an introduction in all aspects of automated driving. As a result, it is useful to all experts working in research and development of ADAS, automated driving and active safety, including sensors, algorithms, human machine interface, communication systems, vehicle interior design, future mobility and traffic concepts.

In particular, the seminar addresses technicians, system and component engineers, project engineers and managers in the automotive industry, both vehicle manufacturers and suppliers who are interested in the actual and future technologies of automated driving and active safety.

Course Contents

- Overview of market trends, the requirements of legislation and consumer ratings
- Advanced Driver Assistance Systems: Functions and technologies
- Motivation, Drivers and benefits of automated driving
- Scenarios of automated driving, the leap from partial to high automation
- Technologies and sensors used, technical gaps and boundaries
- Legal and other challenges, system validation and driver monitoring in particular
- Accident avoidance systems and technologies, the potential of ADAS and autopilots to this effect
- Not yet sufficiently addressed gaps in accident scenarios and accident root causes, based on accident analysis
- Synergies between active and passive safety (Integrated Safety)

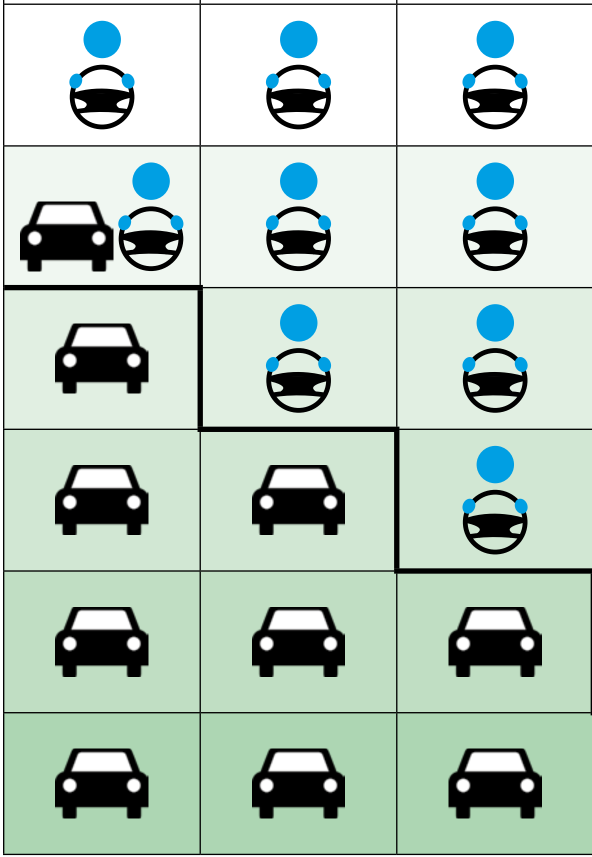
Instructor

Dr. Lothar Groesch has been working in safety engineering for more than 40 years, both at one of the leading OEMs in Passive & Active Safety, and with a major supplier in pioneering new automotive safety sensors & systems. From 2000 to 2009, he worked in the United States as a Product Director for Automotive Safety Systems, thus he is particularly familiar with U.S. specific requirements. Although he only joined the carhs team quite recently, he has a long experience in guest teaching at several universities in the U.S. & Germany, as well as in company internal training seminars, technical marketing, customer presentations & workshops. In 2009 Dr. Grösch has founded Groesch Automotive Safety Consulting and is primarily working in driver assist and accident avoidance systems.

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
06.-07.04.2017	2902	Alzenau	2 Days	1.290,- EUR till 09.03.2017, thereafter 1.540,- EUR	
03.-04.07.2017	2866	Alzenau	2 Days	1.290,- EUR till 05.06.2017, thereafter 1.540,- EUR	
09.-10.11.2017	2867	Alzenau	2 Days	1.290,- EUR till 12.10.2017, thereafter 1.540,- EUR	

Levels of Driving Automation according to BASt, SAE and NHTSA definitions



Execution of Steering and Acceleration/ Deceleration	Monitoring of Driving Environment	Fallback Performance of Dynamic Driving Task	System Capability	BASt Level	SAE Level	NHTSA Level
			-	Driver Only	0 No Automation	0 No Automation
			Some driving modes	Assisted	1 Driver Assistance	1 Function Specific Automation
			Some driving modes	Partially automated	2 Partial Automation	2 Combined Function Automation
			Some driving modes	Highly automated	3 Conditional Automation	3 Limited Self Driving Automation
			Some driving modes	Fully automated	4 High Automation	3 / 4 Limited Self Driving Automation / Full Self Driving Automation
			All driving modes	-	5 Full Automation	

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- Coastdown: J2263, WLTP GTR15
- Pass-By-Noise: R41, R51

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NCAP - New Car Assessment Programs: Tests, Assessment Methods, Ratings

Course Description

In 1978 the first New Car Assessment Program (NCAP) was established by NHTSA in the United States. The goal was to motivate competing car manufacturers to enhance the safety level of their cars beyond the minimum safety standards defined by regulations. The same approach has been followed globally by other organizations (e.g. by Euro NCAP, IIHS, ANCAP, JNCAP, KNCAP,C-NCAP,...) Euro NCAP which has been established in 1997 has taken a leading role and has significantly influenced other countries and regions. The NCAP programs in many cases are highly dynamic, especially in comparison with rule-making activities. In order to reach the goal to continuously improve the safety level of cars, the requirements need to be permanently adapted to the state of technology. Developers in the automotive industry need to know about upcoming changes at an early stage in order to be able to design or equip their vehicles accordingly.

In this seminar attendees get an overview of the organizations in charge of the NCAP programs and become familiar with the various test and assessment methods.

NEW

The seminar is conducted serveral times a year with changing focuses:

- **Focus passive safety:** Here the focus is on test and assessment methods for passive safety. Frontal and side impact, whiplash, child protection and pedestrian protection are discussed in detail. Tests for active safety are only mentioned in as far as they are relevant for the overall rating. (Seminars with a focus on passive safety are higlighted in blue in the table below)
- **Focus active safety:** Here the focus is on active safety systems such as AEB or lane assistance. The tests and assessments for these systems are explained in detail. Test for passive safety are only mentioned in as far as they are relevant for the overall rating. (Seminars with a focus on active safety are higlighted in green in the table below)

In both focusses the current overall rating methods are described and explained. In addition to that an outlook is given on the roadmaps and future developments of the NCAP programs.

Who should attend?

The seminar addresses design, simulation, testing and project engineers as well as managers who want to get a current overview on the global range of NCAP programs with an outlook on upcoming topics and trends from an insider. Depending on the focus of their work attendees should chose the appropriate focus of the seminar.

Course Contents

- New Car Assessment Programs - overview
- U.S. NCAP
- IIHS
- Euro NCAP
- ANCAP
- JNCAP
- Korea NCAP
- China NCAP
- Latin NCAP
- ASEAN NCAP
- BNVSAP
- Global NCAP

Instructor

Director and Professor Andre Seeck (German Federal Highway Research Institute) is head of the division "Vehicle Technology" with the German Federal Highway Research Institute (BASt). In this position he is responsible for the preparation of European Safety Regulations. He is also head of the strategy group on automated driving and represents the German Federal Ministry of Transport and Digital Infrastructure in the Board of Directors of Euro NCAP. These positions enable him to gain deep insight into current and future developments in vehicle safety.

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
20.-21.03.2017	2878	Alzenau	2 Days	1.290,- EUR till 20.02.2017, thereafter 1.540,- EUR	
22.-23.06.2017	2879	Alzenau	2 Days	1.290,- EUR till 25.05.2017, thereafter 1.540,- EUR	
02.-03.11.2017	2880	Alzenau	2 Days	1.290,- EUR till 05.10.2017, thereafter 1.540,- EUR	

SAFETYUPDATE *+active*

The concept is familiar: To keep software up-to-date you regularly make an update. The same is true for automotive safety engineering: To keep yourself up-to-date you have to attend the SafetyUpDate on a regular basis. Here you get a comprehensive overview of all relevant news in automotive safety.

Active + Passive Safety = SafetyUpDate *+active*

The SafetyUpDate reflects the close integration of active and passive safety and combines both topics in one event. General topics such as the NCAP consumer tests are dealt with in plenary presentations, whereas specific topics such as testing are presented in parallel session on active respectively passive safety.

Conference topics include:

- Regulations for active and passive safety
- NCAP consumer protection tests
- Development tools: Test & Simulation
- Development strategies & solutions
- Biomechanics & accident research

From Experts for Experts

The speakers are leading experts from government agencies, consumer protection organizations, industry and universities. We consider it important that the UpDate presentations are product-neutral and practical.

Meeting Point: Expert Dialog

In addition to the presentations the SafetyUpDate encourages the communication among experts. After the presentations the speakers are available for discussions at the Meeting-Point.

Who should attend?

The SafetyUpDate is aimed at automotive developers who are interested in active or passive vehicle safety and want to bring their knowledge up-to-date. In addition to the knowledge update, SafetyUpDate offers excellent opportunities to build and maintain contacts in the safety community.

Facts

DATE	16.-17. May 2017	26.-27. September 2017
HOMEPAGE	www.carhs.de/asu	www.carhs.de/gsu
VENUE	Stadthalle Aschaffenburg	Technische Universität Graz
LANGUAGE	German with translation into English	German with translation into English
PRICE	1.450,- EUR till 18.04.2017, thereafter 1.690,- EUR	1.450,- EUR till 29.08.2017, thereafter 1.690,- EUR

Euro NCAP Test Method for AEB City

Assessment Protocol Version 7.0.3

Test Protocol Version 1.1

AEB City

Approach to stationary target

v_0=10 km/h ... 50 km/h in 5 km/h steps   v=0 km/h

v_0 (km/h)	Points for Accident Avoidance	Remarks
10	1	Prerequisites for scoring in AEB City: ■ minimum 1.5 points (out of 2) from the whiplash assessment of front seats (➲ page 85) ■ up to 20 km/h accidents must be completely avoided
15	2	
20	2	
25	2	For v_0 > 20 km/h accident mitigation is rewarded. The score is calculated from the remaining impact velocity v_i **Points for Accident Avoidance * (v_0-v_i)/v_0** *Example: At v_0=30 km/h the target is impacted at a remaining velocity of v_i=10 km/h:* *2 Points * (30 km/h - 10 km/h) / 30 km/h = 1.333 Points*
30	2	
35	2	
40	1	
45	1	
50	1	
HMI Assessment		AEB City systems, that are default ON at the start of every journey and can not be de-activated by the driver with a single push on a button are awarded **2 Points**

The raw score of a maximum of 14 points from the AEB test is scaled down to a maximum of 2.5 points (scaling factor 0.179). The HMI points are scaled to a maximum of 0.5 points (scaling factor 0.25). The total **maximum score for AEB City is 3 points** and is part of the **Adult Occupant Rating**.

PraxisConference
Autonomous Emergency Braking




The PraxisConference AEB focuses on technical development and testing details of safety-related driver assistance systems, like emergency brake assist and autonomous evasive steering.
First of all, leading experts in the field of requirements and technical solutions present the facts you need to develop and approve AEB systems in accordance with state-of-the-art science and technology. This includes current and upcoming requirements, vehicle presentations, development strategies as well as the question of the responsibility for consequences caused by mistakes of an autonomous driving function. Furthermore, we expand our field of action with heavy commercial vehicles, for which AEB systems are already mandatory.
We are excited to announce that the 2017 PraxisConference AEB takes place at CARISSMA, Technische Hochschule Ingolstadt. The second conference day, called "DemoDay", offers practical sessions on the CARISSMA indoor and outdoor proving grounds. Test equipment, such as targets, driving robots, GPS-technologies and control software, is demonstrated and explained in detail. The preparation, execution and analysis of AEB tests are shown in live demonstrations. For our participants this offers the chance to view the systems under test conditions, clarify their questions and get an overview of test conditions for cars and heavy commercial vehicles.

Conference Topics:

- Legal and consumer protection requirements
- Best practice: testing and simulation
- Outlook on the development process for autonomous evasive steering and driving
- Vehicle technology: introduction of up-to-date driver assistance systems
- Test equipment: targets, driving robots, control and measurement software

Who should attend?

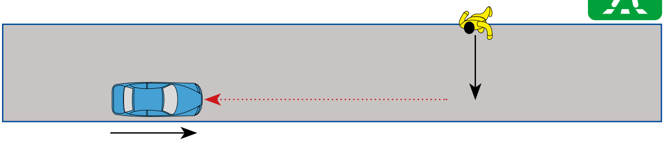
The PraxisConference AEB addresses everyone, who works in the field of safety-related driver assistance systems. If you want to improve your network, you will meet interesting conversation partners with development, system integration, regulation and testing backgrounds.

Facts

DATE	28.- 29. September 2017
HOMEPAGE	www.carhs.de/pkaeb
VENUE	TH Ingolstadt, Esplanade 10, 85049 Ingolstadt
LANGUAGE	German with simultaneous translation into English
PRICE	1.450,- EUR till 31.08.2017, thereafter 1.690,- EUR

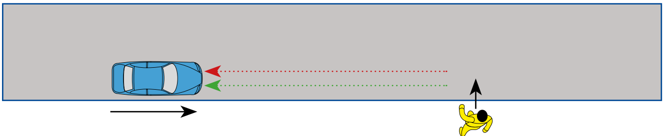
Euro NCAP Test Method for AEB VRU-Pe

Adult, Farside, Impact at 50% of the Vehicle Width (CVFA)



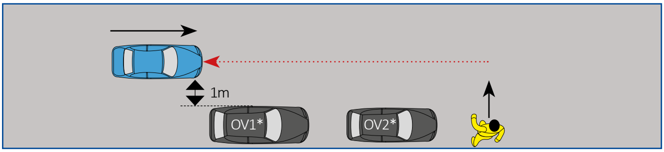
v_0 = 20 km/h ... 60 km/h   v = 8 km/h

Adult, Nearside, Impact at 25 & 75 % of the Vehicle Width (CVNA-25/75)



v_0 = 20 km/h ... 60 km/h   v = 5 km/h

Child, Obscured, Nearside, Impact at 50 % of the Vehicle Width (CVNC)



v_0 = 20 km/h ... 60 km/h;   v = 5 km/h

***Obstruction Vehicle Dimensions:**

	OV 1	OV2
Length (mm)	4300 - 4700	4100 - 4400
Width (mm)	1750 - 1900	1700 - 1900
Height (mm)	1500 - 1800	1300 - 1500

Remarks

- Preconditions for scoring AEB VRU-Pe points:
  - at least 22 points for passive pedestrian protection
  - AEB VRU System must work from 10 km/h in the *CVNA-75* scenario
  - AEB VRU System must reduce speed in the *CVNA-75* scenario at 20 km/h
  - AEB VRU System must be able to detect pedestrians walking as slow as 3 km/h
  - AEB VRU System may not automatically switch off at speeds below 60 km/h.
- HMI assessment
  - no deactivation with a single push on a button: **2 points**
  - FCW function: loud and clear audiovisual warning in critical situations at speeds > 40 km/h, at least 1.2 sec TTC in scenario *CVNA-75* at 45 km/h: **1 point**
  - No switching off at low ambient lighting conditions (< 1000 lux): **1 point**
- Scoring table for all 3 scenarios:

v_0 (km/h)	20	25	30	35	40	45	50	55	60
Points	1	2	2	3	3	3	2	1	1
	scoring by linear sliding scale (e.g. 40 % speed reduction → 40 % score)					min. speed reduction of 20 km/h per test PASS / FAIL			

- For each scenario normalized scores are calculated for AEB. The total normalized AEB score is the average of the scenario scores.
- The total score for AEB-VRU-Pe is the sum of the total normalized AEB score multiplied by 5 and the normalized HMI score, resulting in a **maximum of 6 points** available that are part of the **Pedestrian Protection** assessment.

Example:

Test	***Points***	**max. Points**	***Normalized Score***	**Factor**	***Points***
CVFA	*14.5*	18	*80.6 %*		
CVNA-25	*13.8*	18	*76.7 %*		
CVNA-75	*18.0*	18	*100.0 %*		
CVNC	*8.2*	18	*45.3 %*		
Σ AEB Scenarios	***54.5***	***72***	***75.7 %***	***5x***	***3.785***
HMI	***2***	***4***	***50 %***	***1x***	***0.5***
				total AEB VRU-Pe Score	***4.285***

ADAS Validation

Test & Validation Planning

Measuring Equipment Setup

Validation Tests

Measured Data Documentation

Analysis and Report

- Functional Valididation acc. to NCAPs, OEM Specification
- Functional Valididation acc. to ISO 26262
- Bus Communication Valididation

Application of optimized ADTF Filters and MATLAB Scripts

Contact

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Integral Safety
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65205 Wiesbaden · Germany

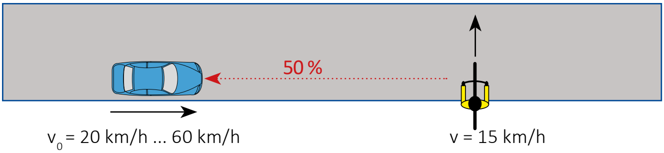
Euro NCAP Test Method for AEB VRU-Cy

Assessment Protocol 9.0

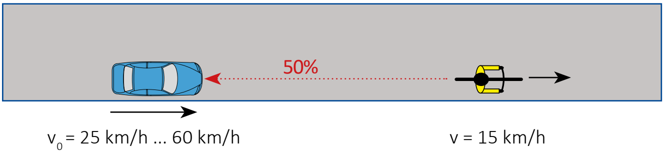
Test Protocol 2.0

AEB VRU-Cy

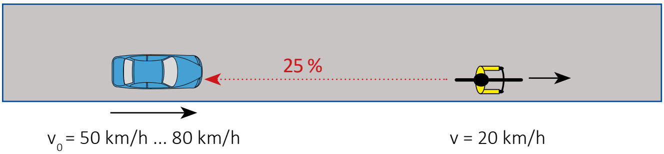
Cyclist, Unobstructed, Nearside, Impact at 50% of the Vehicle Width (CBNA-50)



Cyclist, Unobstructed, Longitudinal, Impact at 50% of the Vehicle Width (CBLA-50)



Cyclist, Unobstructed, Longitudinal, Impact at 25% of the Vehicle Width (CBLA-25)



Prerequistes for scoring:

- the AEB system must be default ON at the start of every journey
- system may not automatically switch off at a speed < 80 km/h
- the score of the pedestrian impact tests (legforms & head) must be ≥ 22 points

Scoring table:

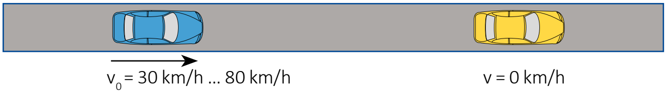
			points available per test speed		
test speed v_0 (km/h)	AEB	FCW	CBNA-50	CBLA-50	CBLA-25
function assessed			AEB	AEB	FCW
20	score = points x (v_0 - v_{impact})/v_0		1		
25			1	1	
30			1	1	
35			1	2	
40			1	2	
45	pass /fail: points are awarded if $v_{impact} \leq v_0$ - 20 km/h		1	3	
50		pass /fail: points are awarded if warning is issued @ TTC ≥ 1.7 s	1	3	3
55			1	3	3
60			1	1	1
65					1
70					1
75					1
80					1
max. total scenario score (1)			9	27	
normalized score (2) = actual score / (1)			(3)	(4)	
AEB Cyclist total points			6 points x ((3) + (4)) / 2		

Additional scenarios will be implemented in 2020.

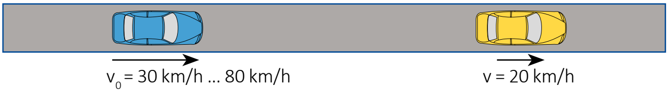
Euro NCAP Test Method for AEB Inter-Urban

AEB Inter-Urban

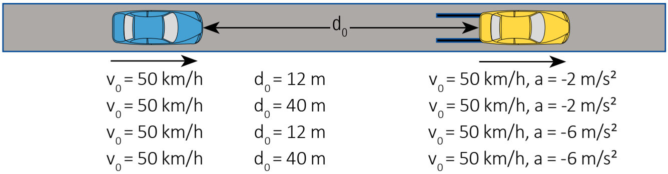
CCRs*: Approach to stationary target



CCRm*: Approach to slower target



CCRb*: Approach to braking target



* CCR: Car-To-Car Rear; s: standing; m: moving; b: braking

	stationary target (CCRs)	slower target (CCRm)		braking target (CCRb)
v_0 (km/h)	Points for FCW	Points for AEB	Points for FCW	
30	2	1	-	1 point each for AEB and for FCW per scenario
35	2	1	-	
40	2	1	-	
45	2	1	-	
50	3	1	1	
55	2	1	1	
60	1	1	1	
65	1	2	2	
70	1	2	2	
75	1	-	2	
80	1	-	2	
Σ	**18**	**11**	**11**	**2 x 4**

HMI Assessment	
	■ Preconditions for HMI points: AEB and/or FCW system are default ON at the start of every journey and the FCW alert (if available) is loud and clear. ■ Systems that can not be de-activated with a single push on a button are awarded **2 points** ■ Supplementary warning for the FCW system(e.g. head-up display, belt jerk, brake jerk): **1 point** ■ Reversible pre-tensioning of the belt in the pre-crash phase: **1 point**

The total AEB Inter-Urban score results from the following weighting of the normalized scores (%):
AEB Inter-Urban = FCWscore x 1.0 + AEBscore x 1.5 + HMIscore x 0.5
This results in a **maximum total score of 3 points for AEB Inter-Urban**, which is part of the **Safety Assist** assessment.
The AEBscore (respectively FCWscore) is the average score from all the scenarios.

Example:

System	*FCW*			*AEB*		*HMI*		
Scenario	*CCRs*	*CCRm*	*CCRb*	*CCRm*	*CCRb*	*De-activation*	*Warning*	*Pretension*
Points	*15.264*	*8.404*	*4*	*5.078*	*2.700*	*2*	*0*	*0*
Score	*84.7 %*	*76.4 %*	*100.0 %*	*46.2 %*	*67.5 %*	*50.0 %*		
	FCWscore = (84.7 % + 76.4 % + 100 %) / 3 = 87.0 %			*AEBscore = (46.2 % + 67.5 %)/2 = 56.9 %*		*HMIscore = 50.0 %*		
Total	*87 % x 1.0 + 56.9 % x 1.5 + 50 % x 0.5 = 1.974 points (out of 3)*							

For systems that only offer the AEB function, the results of tests at all speeds (covering AEB and FCW) are used to calculate separate normalized AEB and FCW scores for each scenario. Where AEB and FCW test speeds are overlapping, the test result of AEB is duplicated for FCW.

DEKRA Automobile Test Centre Klettwitz.
Expertise in child safety.

As an integral part of the DEKRA Technology Centre, the DEKRA Automobile Test Centre at the EuroSpeedway Lausitz is divided into four centres of expertise, so-called modules. A special core field of activity is assigned to each of these modules. With the development of the new i-Size test system in 2015, an important aspect has now been added to the range of services for child seats.

Test types
- > Sled and catapult facility for frontal, side and rear impact tests on ECE bench or in vehicle bodies
- > Rollover test bench
- > i-Size measurement
- > Temperature test
- > Energy absorption
- > Conditioning of components

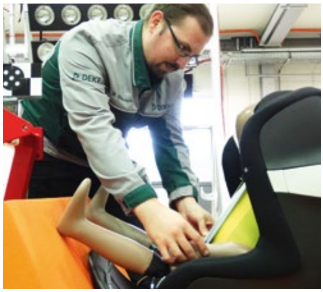
Tasks
- > Development tests
- > Homologation service according to ECE R44 and 129
- > Customer requirements
- > COP tests

Accreditation as test laboratory according to ISO 17025
- > Germany – DakkS

Designation as Technical Service
- > Germany – KBA
- > Netherlands – RDW

Test bench for lateral impact, child seats

Test bench for rear impact, child seats



DEKRA Automobil Test Center
Senftenberger Straße 30 | 01998 Klettwitz
Phone: +49.35754.7344-500 | Fax: +49.35754.7345-500

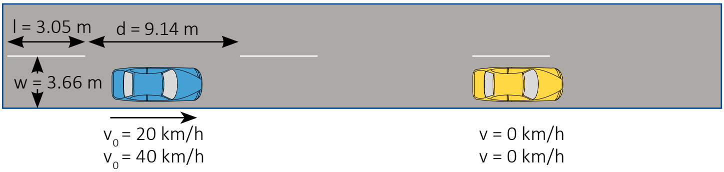
www.datc.de

Alles im grünen Bereich.

IIHS AEB / Front Crash Prevention Test

AEB Test Protocol, V. I, Oct. 2013

Approach to stationary target



Assessment:

	20 km/h Test			40 km/h Test				FCW
Speed reduction	< 8 km/h	8-14 km/h	≥ 15 km/h	< 8 km/h	8-14 km/h	15-34 km/h	≥ 35 km/h	
Points	0	1	2	0	1	2	3	1

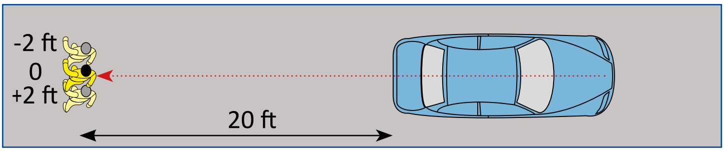
Rating Scheme:

Points	1	2- 4	> 5
Rating	BASIC	ADVANCED	SUPERIOR

U.S. NCAP Rear Automatic Braking*

Rear Automatic Braking Feature Confirmation Test Procedure (Working Draft), Dec. 2015

Child, 20 ft (6.096 m) behind rearmost point of bumper @ 0/+2/-2 ft from centerline



Dummy

- 4a Euro NCAP Pedestrian - Child Dummy static

Test-Procedure

- Place the direction selector in reverse while maintaining full pressure on the brake pedal.
- Release the vehicle's brake pedal and allow the vehicle to coast backward while maintaining the vehicle's centerline within +/- 1 inch of the longitudinal line marked on the ground.
- Allow the vehicle to coast until the rear automatic braking feature intervenes by automatically engaging the service brakes bring the vehicle to a stop or until the vehicle strikes the test object. Once either of these two outcomes occurs, the vehicle's brake pedal should be depressed to end the test trial. Every effort must be made to safely conduct this test. If testing indoors, proper ventilation must be provided. No personnel shall be located to the rear of a test vehicle at any time during the test trial.

Requirements

- A positive test outcome would involve the vehicle coming to a stop before it reaches the location of the test object and with no physical contact with the test object for each of the three test object locations assessed.

* Please note: The rear automatic brake test is part of the U.S. NCAP upgrade planned for model year 2019. The test procedure and requirements are based on "Rear Automatic Braking Feature Confirmation Test Procedure (Working Draft), December 2015". Docket NHTSA-2015-0119.

U.S. NCAP Crash Imminent Braking

CRASH IMMINENT BRAKE SYSTEM PERFORMANCE EVALUTION, October 2015

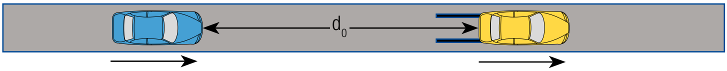
LVS (Lead Vehicle Stopped)
Approach to stationary target

v_0 = 25 mph (40.2 km/h) v = 0 mph

LVM (Lead Vehicle Moving)
Approach to slower target

v_0 = 25 mph (40.2 km/h)
v_0 = 45 mph (72.4 km/h)
v = 10 mph (16.1 km/h)
v = 20 mph (32.2 km/h)

LVD (Lead Vehicle Decelerating)
Approach to braking target



v_0 = 35 mph (56.3 km/h) d_0 = 45.3 ft (13.8 m) ± 8 ft (2.4 m) v_0 = 35 mph (56.3 km/h). a = -0.3 g

False Positive Test
Approach to steel trench plate

v_0 = 25 mph (40.2 km/h)
v_0 = 45 mph (72.4 km/h)
8 ft x 12 ft x 1 in (2.4 m x 3.7 m x 25 mm)

Requirements

Scenario	LVS	LVM 25 mph	LVM 45 mph	LVD	False Positive
Require-ment	Δv ≥ 9.8 mph (15.8 km/h)	no impact	Δv ≥ 9.8 mph (15.8 km/h)	Δv ≥ 10.5 mph (16.9 km/h)	deceleration ≤ 0.5 g

U.S. NCAP Forward Collision Warning

FORWARD COLLISION WARNING SYSTEM CONFIRMATION TEST, Feb 2013

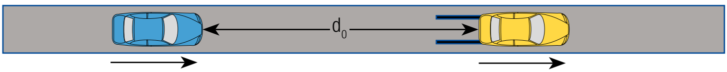
LVS (Lead Vehicle Stopped)
Approach to stationary target

v_0 = 45 mph (72.4 km/h) v=0 mph

LVM (Lead Vehicle Moving)
Approach to slower target

v_0 = 45 mph (72.4 km/h) v=20 mph (32.2 km/h)

LVD (Lead Vehicle Decelerating)
Approach to braking target



v_0 = 45 mph (72.4 km/h) d_0 = 89.4 ft (30 m) ± 8.2 ft (2.5 m) v_0 = 45 mph (72.4 km/h). a = -0.3 g

Requirements

Scenario	LVS	LVM	LVD
Require-ment	Alert no later than 2.1 s TTC	Alert no later than 2.0 s TTC	Alert no later than 2.4 s TTC


TRAFFIC INFORMATION
FOR DRIVERS
4 KM OF
SLOW
MOVING
TRAFFIC AHEAD
ADJUST SPEED
TRAFFIC JAM ASSIST
STAY IN LANE
IN STOP&GO MODE
CONTINUE DRIVING STRESS-FREE
ZF–NETWORKING MECHANICAL AND ELECTRONIC SYSTEMS WITH ADVANCED INTELLIGENCE
ZF.COM/TECHNOLOGY-TRENDS

Car Body Design for Analysis Engineers

Course Description

In general analysis engineers have a sound knowledge on numerical methods and experience in structural analysis with the Finite Element Method. To make a valuable contribution to the vehicle development process using numerical simulation, knowledge on car body design and functional layout is required. To efficiently undertake lightweight design all fundamental requirements have to be taken into account early in the design process. These requirements will be outlined in the seminar. Additionally the characteristics of the specific organization of the development process have to be incorporated.

Course Objectives

The objective of the seminar is to transfer the knowledge needed for an analysis engineer to play a part in vehicle development. Especially the examination of design variants of existing car bodies makes the seminar descriptive and practical.

Who should attend?

This 2 day seminar is aimed at analysis engineers working in the automotive industry.

Course Contents

- Load carrying principles of lightweight design
  - Load assumptions
  - Design principles
- Technology of car body construction
  - Car body architecture
  - Structural materials and pre-products
  - Material selection
  - Manufacturing methods
  - Joining techniques
- Development process described at the example of the improvement of static properties
  - Principal structure of the development process
  - CAE-compatible CAD
  - Finite Element modelling of a car body
  - Static behaviour of the car body structure
  - Finite Element Analysis of joints
- Measures for improved dynamic behavior
  - Part dimensioning taking into account vehicle vibrations
  - Dynamic analysis of full vehicles
- Measures for improved acoustic behavior
  - Acoustic design of a car body
  - Simulation methods
- Realization of safety measures
  - Energy absorption elements
  - Vehicle car bodies
  - Safety systems
  - Pedestrian protection
  - Post crash
- Use of optimization methods in industrial applications
  - Introduction into mathematical optimization
  - Approximation techniques
  - Optimization software
  - Optimization strategies
  - Shape optimization
  - Topology optimization

Instructor

Prof. Dr.-Ing. Axel Schumacher (University of Wuppertal) studied mechanical engineering at the universities of Duisburg and Aachen. He received his doctorate on structural optimization from the university of Siegen. Following research projects for Airbus were focused on the optimization of aircraft structures. Thereafter he worked in the CAE methods development department of Adam Opel AG as project leader for structural optimization. From 2003 - 2012 he was a professor at the University of Applied Sciences in Hamburg and taught structural design, passive safety and structural optimization. Since 2012 he has been professor at the University of Wuppertal, where he holds the chair for optimization of mechanical structures.

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
19.-20.06.2017	2922	Alzenau	2 Days	1.290,- EUR till 22.05.2017, thereafter 1.540,- EUR	
13.-14.11.2017	2921	Alzenau	2 Days	1.290,- EUR till 16.10.2017, thereafter 1.540,- EUR	

Lightweight Design Strategies for Car Bodies

Course Description

Designing and developing light weight vehicles ready for series production is becoming increasingly important. Especially for fully electric vehicles with large and heavy battery packs light car bodies are indispensable. But also for other propulsion concepts lightweight is desirable. The focus in this seminar will be given to production ready vehicle concepts. Ideas taken from the extreme light weight design are integrated into the considerations. A symbiosis of the use of modern lightweight materials and the design of appropriate lightweight structures leads to efficient lightweight design. This multi-disciplinary task is only possible with development strategies that can simultaneously handle requirements of crash protection, vehicle dynamics, comfort, acoustics, durability and production of the vehicle. The aim of this seminar is to provide the competencies for the development of light vehicle structures.

Who should attend?

This seminar is aimed at designers, analysis engineers and project managers from car body, component and system development.

Course Contents

- Potentials of lightweight design
  - Motivation and problem definition
  - Current lightweight vehicle concepts
  - The "Lightweight Loop"
- Principles of lightweight design
  - Definition of requirements
  - Determination of design loads
  - Principal design rules
  - Approaches of bionics
  - Fail-safe, safe life, damage tolerance
  - Methodical concept finding (architecture, topology)
- Materials and their specific design rules
  - Material selection
  - Acquisition of material data
  - Steel, aluminum, magnesium
  - Fiber composites
  - Material mix and recycling
- Structures of lightweight design
  - Space-frame structures
  - Shell structures (beads, ribs, ...)
  - Foams and inlays
  - Composite sandwich structures
  - Related joining techniques (adhesive bonding, ...)
- Advanced CAE methods for lightweight design
  - Stability (buckling, ...)
  - Dynamics and Acoustics
  - Fracture mechanics, multi-scale models (observation of cracks, etc.)
  - Crash of small structures
  - Analysis of joints
  - Robustness analysis
  - Optimization of shape and dimension
- Case studies
  - Selected Vehicle Components
  - Ultra-lightweight vehicle concepts
  - Vehicle concepts for mass production

Instructor

Prof. Dr.-Ing. Axel Schumacher (University of Wuppertal) studied mechanical engineering at the universities of Duisburg and Aachen. He received his doctorate on structural optimization from the university of Siegen. Following research projects for Airbus were focused on the optimization of aircraft structures. Thereafter he worked in the CAE methods development department of Adam Opel AG as project leader for structural optimization. From 2003 - 2012 he was a professor at the University of Applied Sciences in Hamburg and taught structural design, passive safety and structural optimization. Since 2012 he has been professor at the University of Wuppertal, where he holds the chair for optimization of mechanical structures.

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
27.-28.03.2017	2828	Alzenau	2 Days	1.290,- EUR till 27.02.2017, thereafter 1.540,- EUR	
23.-24.11.2017	2923	Alzenau	2 Days	1.290,- EUR till 26.10.2017, thereafter 1.540,- EUR	

»AUTOMOBIL INDUSTRIE« LEICHTBAUGIPFEL

The »Automobil Industrie« - Light Weight Design Summit is the high level networking event for the pioneers in automotive lightweighting. The focus theme for 2017 is "E-Mobility – new Opportunities for Light Weight Design“. Meet OEMs and suppliers on 09./10. March 2017 at the Vogel Convention Center in Würzburg, Germany.
Keynotes and expert presentations, technical sessions and live demonstrations highlight the importance of lightweighting for the future of electric vehicles.

Discussions about innovative ideas and the networking betwenn experts from OEMs and suppliers are at the core of the Light Weight Design Summit.

About the Focus Theme:

Digitization, connectivity, autonomous driving, electrification: Will these automotive mega-trends move light weight design into the background?
Not at all, because all the new topics are added to the existing requirements on the current vehicles architecture. And they further increase the need for lightweighting in order to stay within weight boundaries.
In particular the electrification of the powertrain will leverage light weight design. Batteries, power electronics and E-drives will add weight as do new crash-protective enclosures for the batteries. Material selection and new design concepts create new challenges for the designer.
The future will be E-mobility, and current vehicle concepts will have to be revised or newly developed. The new approach is to revolutionize the vehicle body concepts while evolving the material concepts. This involves a substantial business potential - also for the suppliers.

Who should attend:

The Automobil Industrie Light Weight Design Summit is the platform for the communication between OEMs and suppliers. The summit addresses the technical management/CEO level of OEMs and suppliers, the purchasing management, heads of development and design, project engineers, innovation managers and materials specialists.

Facts

DATE	9.-10. March 2017
HOMEPAGE	www.leichtbau-gipfel.de
VENUE	Vogel Convention Center, Würzburg
LANGUAGE	German with simultaneous translation into English
PRICE	980,- EUR till 31.01.2017, thereafter 1.180,- EUR

Robust Design - Vehicle Development under Uncertainty

Course Description

The seminar addresses the current state of the art complemented by recent achievements in research and development to quantify and control uncertainties (lack-of-knowledge and variations) in vehicular development. Aspects of sensitivity and robustness analysis are discussed as well as topics in reliability, resilience, redundancy and model uncertainty. In addition, numerical methods for optimization with consideration of uncertainties and methods for model order reduction (MOR) to reduce computational effort are discussed. Applications (e.g. NVH, crash) illustrate the usage of the methods and the fact that methods should be adapted to the degree of maturity of the design in the development process.

Course Objectives

The seminar is focused on methods and their theoretical background to enable the participants to realize applications directly in the industrial context. Hence, uncertainties can be characterized, quantified, and – together with sensitivity analysis – concept and structural evaluations are made possible, which consider robustness, reliability, resilience, and redundancy. Corresponding optimizations can then be realized in an efficient manner.

Who should attend?

The seminar is proposed for engineers with first experiences in numerical concept and series development of vehicles, who are interested in including robustness, reliability and other aspects of uncertainty management in their industrial designs.

Course Contents

- Mathematical methods for uncertainty quantification
- Linear and non-linear sensitivity analysis (global / local)
- Design of Experiments (DoE), Response Surface Methods (RSM)
- Methods for model order reduction (MOR)
- Robustness versus reliability
- Robustness in early design stages (Set-based Design und Solution Space Approach)
- Methods for resilience, redundancy, model uncertainty
- Optimization under uncertainties
- Applications taken from acoustics and crashworthiness

Instructor

Prof. Dr.-Ing. Fabian Duddeck (Technical University Munich) leads the research group on optimization and robustness at the Technische Universität München (TUM) since 2010. His research is focusing on shape and topology optimization for crash, NVH (noise vibration and harshness) and other disciplines including stochastic modeling and robustness assessments. Holding the chair for Computational Mechanics at the TUM, he also teaches and directs research at Queen Mary University of London (QMUL) and at the French Ecole des Ponts ParisTech (ENPC). His group is involved in industrial as well as national and international research projects. Prof. Duddeck has obtained his PhD (1997) and his Habilitation degree (2001) at the Technische Universität München.

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
13.-14.02.2017	2818	Alzenau	2 Days	1.290,- EUR till 16.01.2017, thereafter 1.540,- EUR	
12.-13.09.2017	2950	Alzenau	2 Days	1.290,- EUR till 15.08.2017, thereafter 1.540,- EUR	

automotive CAE GRAND CHALLENGE 2017

In the last 20 years computer simulation has become an indispensable tool in automotive development. Tremendous progress in software and computer technology makes it possible today to assess product and process performance before physical prototypes have been built. Despite of significant progress in simulation technology and impressive results in industrial application there remains a number of challenges which prevent a "100% digital prototyping". We at carhs.training call these Grand Challenges.

Automotive CAE Grand Challenge offers a platform for dialog

The automotive CAE Grand Challenge stimulates the exchange between users, scientists and software developers in order to solve these challenges. Annually the current, critical challenges in automotive CAE are being identified through a survey among the simulation experts of the international automotive industry. In the conference one session is dedicated to each of the most critical challenges, the so-called Grand Challenges. In each session CAE experts from industry, research and software development will explain the importance of the individual Challenge for the virtual development process and talk about their efforts to solve the challenge.

Automotive CAE Grand Challenges 2017

In September 2016 we have determined the important current challenges of automotive CAE - the so-called "Grand Challenges" - through a survey among the CAE experts of the international automotive industry. The below listed "Grand Challenges" form the topics of the sessions of our automotive CAE Grand Challenge 2017 conference.

- Crash: Material and failure models of plastics
- Fatigue: Virtual proofing ground, determination of load collectives
- NVH: Squeak and rattle, groaning
- Multi simulation: Multi trade simulation, influence of manufacturing on material and product
- Optimization: Topology optimization
- Safety: Stability of dummy models, including scatter of hardware dummies
- Strength: Failure models for adhesives

Who should participate?

The conference intends bringing together industrial users, researchers and software developers to discuss these current, critical challenges of automotive CAE and to initiate collaboration between these groups to help overcoming the Grand Challenges of automotive CAE. The presentation program of the conference provides both experts and beginners valuable information for their daily work. The possibility to meet and exchange with all stakeholders of automotive CAE is a great opportunity. In the accompanying exhibition participants can receive additional information from leading companies of CAE.

Facts

DATE	05.- 06. April 2017
HOMEPAGE	www.carhs.de/grandchallenge
VENUE	Congress Park Hanau, Schloßplatz 1, 63450 Hanau
LANGUAGE	English
PRICE	850,- EUR till 08.03.2017, thereafter 980,- EUR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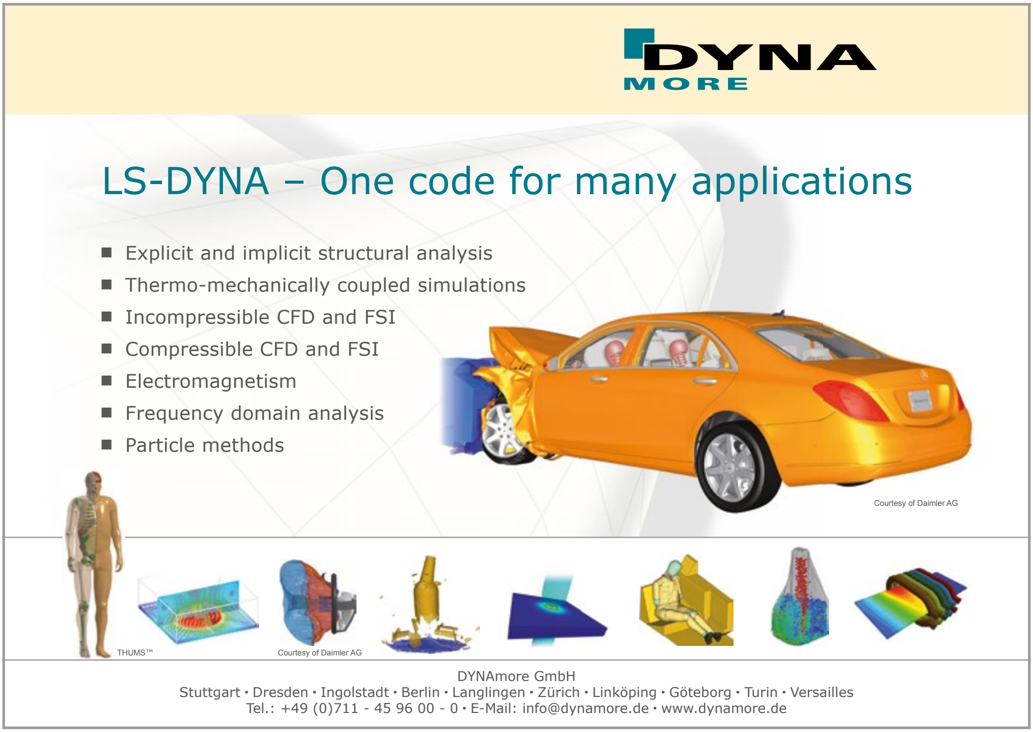
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Material Models of Composites for Crash Simulation

Course Description

Increasing demands for weight reduction paralleled by requirements for improved crash performance and stiffness of structures have strongly pushed the development of advanced composites. The use of composite materials today is not limited to niche applications or secondary parts; they are increasingly used for important load carrying structural components in series production.

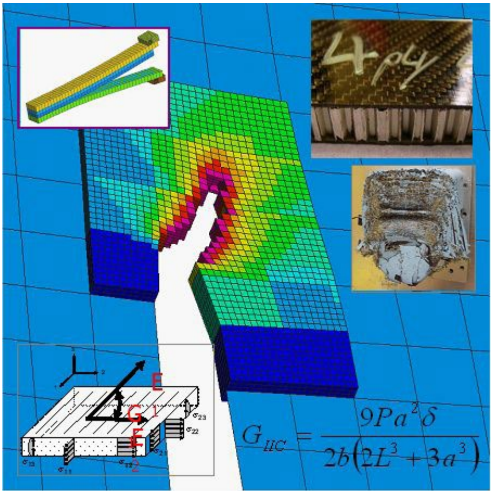
In this one day seminar Prof. Thomas Karall presents the foundations of structural impact and crash analysis of composites with the Finite Element Method. At the beginning of the seminar an overview of current and upcoming industrial applications of composite materials is given. Thereafter concepts for the correct physical modeling of the complex load degradation and failure mechanisms in numerical simulation are presented. The course concentrates on the numerical simulation of the crash behavior of composites and is accompanied with demonstrations using the PAM-CRASH code.

Who should attend?

The course addresses simulation and project engineers, project managers as well as researchers involved in the analysis and design of composite parts and structures.

Course Contents

- Current and upcoming areas of application of composite materials
- Analysis of composite materials
- Available material models and their application
- Modelling methods for plies and laminates
- FEM modelling of composites
- Failure mechanisms and their representation
- PAM-CRASH ply and delamination models
- Necessary material tests
- Examples



Instructor

Prof. Dr. Thomas Karall (Hof University of Applied Sciences) studied mechanical engineering at the Technical University of Vienna and received his PhD as Assistant Professor at the University of Leoben in the field of fibre-reinforced plastics and the calculation by finite elements. From 2006 to 2010 he was head of department at the Austrian Research Institute for Chemistry and Technology in Vienna in the field of mechanical and thermal testing / fibre composites, and Secretary General of the Austrian Working Group for reinforced plastics. From 2010 to 2015 he worked as Lead Researcher for lightweight design at Virtual Vehicle Research Center in Graz. He was also a lecturer at the Technical University of Graz and lecturer at the FH Joanneum Graz. Since 2015 he has been Professor at the Engineering Department of the Hof University. His areas of work include lightweigt design, fibre-reinfoced composites and the finite element method.

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
12.05.2017	2946	Alzenau	1 Day	740,- EUR till 14.04.2017, thereafter 890,- EUR	English
27.10.2017	2947	Alzenau	1 Day	740,- EUR till 29.09.2017, thereafter 890,- EUR	German

Material Models of Metals for Crash Simulation

Course Description

Besides an appropriate spatial discretisation of the structure and a profound knowledge of the required load cases, appropriate material modelling is a key ingredient for predictive crash simulations. The load carrying structure of a car today still mainly consists of metallic materials. The materials to be described are diverse.

The seminar deals with the following materials:

- mild and high strength steels,
- cold formable AHSS and UHSS steels,
- hot formable and quenchable boron steels,
- wrought Al and Mg alloys,
- cast Al and Mg alloys.

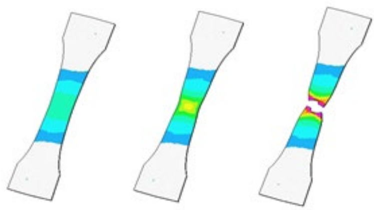
The objective of this 1 day course is to give the participants an overview of material models of metals used in crash simulation. In a first step the deformation behavior and the failure mechanisms of each material class are explained based on the material structure. The influence of strain rate on material behavior is an important aspect in the context of crash simulation and will be discussed in the seminar. In a second step phenomenological material models for crash simulation are introduced. In the third step the tests needed for the characterization of materials are described and the parameter identification for the material models is discussed. Finally and using example simulations the sensitivity of simulation results regarding the identified material parameters is shown.

Who should attend?

The course addresses engineers working in the field of crash simulation and heads of simulation departments interested in the important topic of material modelling.

Course Contents

- Overview of metallic materials used in cars
- Influence of material structure on mechanical behavior
- Phenomenological material models for metals
- Overview of experimental methods for material characterization
- Identification of material parameters from experiments
- Discussion of the sensitivity material parameters



Instructor

Dr.-Ing. Helmut Gese (MATFEM - Partnerschaft Dr. Gese & Oberhofer) founded the engineering consultancy MATFEM (from 1999 the company has been named MATFEM partnership Dr. Gese & Oberhofer) in 1993. MATFEM offers technical and scientific consultancy services at the intersection of material science and finite element methods. Besides performing FEM analysis projects the area of activity covers experimental and theoretical characterization of materials and the development of new material models for simulation.

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
09.05.2017	2899	Alzenau	1 Day	740,- EUR till 11.04.2017, thereafter 890,- EUR	English
26.10.2017	2900	Alzenau	1 Day	740,- EUR till 28.09.2017, thereafter 890,- EUR	German

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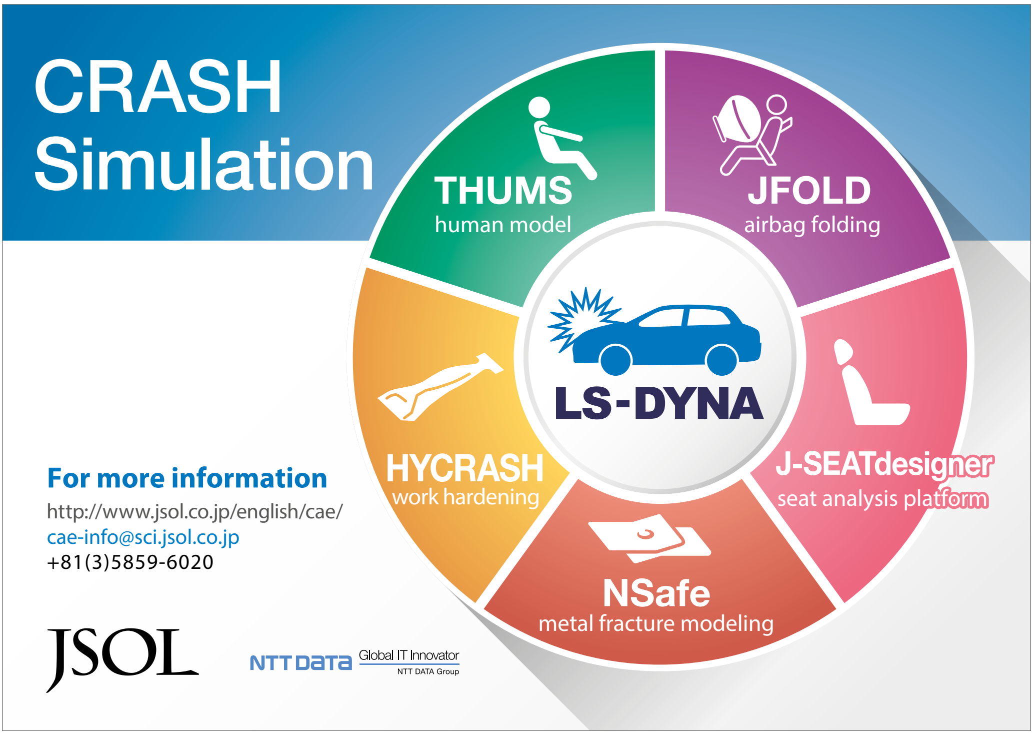

CRASH Simulation
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Material Models of Plastics and Foams for Crash Simulation

Course Description

Numerical simulation has become a fundamental element in the development of motor vehicles. Today, many important design decisions, especially in the field of crash, are based on simulation results. During the last few years there has been an increase in the use of foams in vehicles. These are, due to their variety and structure, much more complicated regarding the characteristics of the materials than "simple" materials such as steel or aluminum, which can be modelled rather well. Characterization of foam materials is a great challenge for the simulation expert. Although by now there are different modelling approaches available in explicit FEM-programs such as LS-DYNA and PAM-CRASH, these are, however, often not satisfactory. The application of these special material models requires a sound knowledge and experience.

The seminar provides an overview over plastics and foam materials used in automotive engineering and their phenomenology. On the first day you obtain an introduction into the simulation of elastic and visco-elastic polymers, such as elastomers and elastic polymer foams with volume elements. You are thereby coming to understand the available material models in explicit finite element programs.

On the second day the focus is on the treatment of plastics, such as thermo- and duroplastics through elasto-plasticity with isotropic hardening. Non-associated deformation is going to be discussed as well. The seminar is rounded off with the procedure for simulation of glass-fiber reinforced plastics using both isotropic and anisotropic material laws.

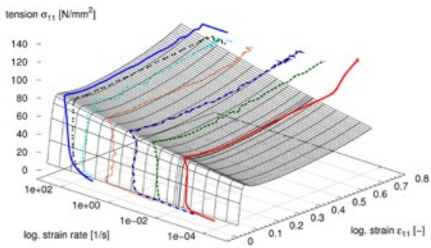
For a demonstration you are going to see examples created with the program LS-DYNA. References to material models in LS-DYNA and PAM-CRASH are going to help you in applying what you will have learnt.

Who should attend?

The seminar addresses experienced CAE engineers and heads of CAE departments with an interest in plastic and foam materials simulation. At least 1-year of experience with FEM-programs such as LS-DYNA and PAM-CRASH is suggested for participating in this course.

Course Contents

- Overview of polymer materials used in vehicle construction
- Verification and validation procedure for crash simulation
- Introduction to mechanics of materials
- Simulation of elastic and visco-elastic rubbers and foams with volume elements
- Overview of available material models in explicit finite element codes
- Simulation of elastic-plastic polymers under crash loading for validation
- Simulation of anisotropic materials with application to glass-fiber reinforced plastics



Instructor

Prof. Dr.-Ing. Stefan Kolling (Giessen University of Applied Sciences) is Professor for Mechanics at the Giessen University of Applied Sciences (THM). Previously he worked as a simulation engineer at the Mercedes Technology Center in Sindelfingen. He was responsible for methods development in crash simulation. In particular he was involved in the modelling of non-metal materials such as glass, polymers and plastics. Prof. Kolling graduated from the Universities of Saarbrücken and Darmstadt, from where he also received his Ph.D. He is author of numerous publications in the field of material modeling.

Dates & Venues

DATE	COURSE ID	VENUE	DURATION	PRICE	LANGUAGE
10.-11.05.2017	2909	Alzenau	2 Days	1.290,- EUR till 12.04.2017, thereafter 1.540,- EUR	English
24.-25.10.2017	2910	Alzenau	2 Days	1.290,- EUR till 26.09.2017, thereafter 1.540,- EUR	German

Important Abbreviations

A

A-PCS	Advanced Pre-Collision System (Lexus)
AAA	American / Australian Automobile Association
AAAM	Association for the Advancement of Automotive Medicine
AAM	Alliance of Auto Manufacturers (OSRP, USCAR)
aBAS	Advanced Brake Assist System
ACC	Adaptive Cruise Control
ACEA	Association of European Automobile Manufacturers
ACL	Anterior cruciate ligament
ACN	Automatic Collision Notification
ACU	Airbag Control Unit
ADAC	Allgemeiner Deutscher Automobil Club (German Automobile Association)
ADAS	Advanced Driver Assistance Systems
ADOD	Average Depth of Deformation
ADR	Australian Design Rules
AE-MDB	Advanced European Mobile Deformable Barrier
AEB	Autonomous Emergency Braking
AEBS	Autonomous Emergency Brake System
AHOD	Average Height of Deformation
AHOF	Average Height of Force
AHR	Active Head Rest
AIS (1)	Abbreviated Injury Scale
AIS (2)	Automotive Industry Standards
AISC	Automotive Industry Standards Committee
ANCAP	Australasian New Car Assessment Program
AOP	Adult Occupant Protection (Euro NCAP)
APF	Abdominal Peak Force
APPO	Assessment Protocol Prove Out (Euro NCAP)
APROSYS	Advanced PROtection SYStems
APSS	Active Pedestrian Safety System
ARAI	Automotive Research Association of India
ASCC	Adaptive Speed Cruise Control
ASIC	Application-Specific Integrated Circuit
ASIL	Automotive Safety Integrity Level (functional safety)
ASIS	Adavanced Side Impact System
ATD	Anthropomorphic Test Device
AZT	Allianz Zentrum Technik

B

BAS	Brake Assist
BASt	Germany's Federal Highway Research Institute
BDA	Bonnet Deployment Actuator
BIS	Bureau of Indian Standards
BLE	Bonnet Leading Edge
BMVI	German Federal Ministry of Transport and digital Infrastructure
BoD	Board of Directors (Euro NCAP)
BOS	Beginning of Steer
BRIC	Brain Injury Criterion
BSD	Blind Spot Detection

C

C-NCAP	China New Car Assessment Programme
C2C	Car-to-Car
CA	Crash Avoidance
CAD	Computer Aided Design
CAE	Computer Aided Engineering
CAN	Controller Area Network
Cars21	A Competitive Automotive Regulatory System for the 21st Century
CAT	Computer Aided Testing
CATARC	China Automotive Technology and Research Center
CCD	Charge Coupled Device
CCIS	Co-operative Crash Injury Survey
CCR	Car to Car-Rear
CDC	Collision Deformation Classification
CEA	Comité Européen des Assurances
CFD	Computational Fluid Dynamics
CFR	Code of Federal Regulations (USA)
CFRP	Carbon Fiber Reinforced Plastic
CIB	Crash Imminent Braking
CLEPA	Comité de liaison européen des fabricants d'equipements et de pièces automobiles
CMbB	Crash Mitigation by Braking (Ford)
CMBS	Crash Mitigation Brake System (Honda)
CMM	Coordinate Measuring Machine
CMOS	Complementary Metal Oxide Semiconductor
CMVR	Central Motor Vehicle Rules
CMVSS	Canadian Motor Vehicle Safety Standards
COG	Center of Gravity
CONTRAN	Conselho Nacional de Trânsito
COP (1)	Carry over Parts
COP (2)	Child Occupant Protection (Euro NCAP)
COS	Completion of Steer
CP	Contact Point
CRABI	Child Restraint Airbag Interaction (Child Dummy), USA
CRS	Child Restraint System
CSM	Computational Structural Mechanics
CSMA/CA	Carrier Sense Multiple Access / Collision Avoidance
CSMA/CD	Carrier Sense Multiple Access / Collision Detection
CV	Closing Velocity
CVFA	Car to Vulnerable road user Farside Adult
CVNA	Car to Vulnerable road user Nearside Adult
CVNC	Car to Vulnerable road user Nearside Child

D

DAS	Data Acquisition System
DBS	Dynamic Brake Support
DCU	Domain Control Unit
DGPS	Differential Global Positioning System
DLO	Daylight Opening
DT	Deployment Time

E

EBA	Emergency Brake Assist
EBD	Electronic Brake Force Distribution
ECE	Economic Commision for Europe (United Nations)
ECOSOC	United Nationions Economic and Social Council
EDM	Engineering Data Management
EES	Energy Equivalent Speed
EEVC	European Enhanced Vehicle-Safety Committee
ELSA	ELectric SAfety (UNECE/WP29 Working Group)
EMC	Electromagnetic Compatibility
EOU	Ease of use
ES-2 re	Euro SID 2 Rib Extension
ESC	Electronic Stability Control
ESV	Enhanced Experimental Vehicles Safety Program / Enhanced Safety of Vehicles Prog.
ETC	European Test Consortium
ETSC	European Transport Safety Council
Euro NCAP	European New Car Assessment Programme
EVITA	Experimental Vehicle for Unexpected Target Approach (TU Darmstadt)
EVPC	Electric Vehicles Post Crash
EVT	Euro NCAP Vehicle Target

F

FARS	Fatality Analysis Reporting

Important Abbreviations

	System
FCW	Forward Collision Warning
FCWS	Forward Collision Warning System
FEM	Finite Element Method
FFC	Femur Force Criterion
Flex PLI	Flexible Pedestrian Legform Impactor
FMH	Free Motion Headform (FMVSS 201)
FMVSS	Federal Motor Vehicle Safety Standards
FPS	Frontal Protection System
FPSLE	Frontal Protection System Leading Edge
FRG	Floating Rib Guide
FRP	Fiber Reinforced Plastic
FSI	Fluid-Structure-Interaction
FTDMA	Flexible Time Division Multiple Access
FW	Full Width
FWDB	Full Width Deformable Barrier
FWRB	Full Width Rigid Barrier

G

G.S.R.	General Statutory Rules
GAMBIT	Generalized Acceleration Model for Brain Injury Threshold
GCS	Glasgow Coma Scale
GIDAS	German in-Depth Accident Study
GRSG	Groupe de Rapporteurs sur la Sécurité Générale (WP29 - General Safety Provisions)
GRSP	Groupe de Rapporteurs sur la Sécurité Passive (WP29 - Passive Safety)
GSR	General Safety Regulations
GTR	Global Technical Regulation
GVM	Gross Vehicle Mass
GVWR	Gross Vehicle Weight Rating

H

HBM	Human Body Model
HGV	Heavy Goods Vehicle
HIC	Head Injury Criterion
HIT	Head Impact Time
HITS	Harmonisation Interlab Test Series
HLDI	Highway Loss Data Institute
HLLC	High Level Liaison Committee
HMI	Human Machine Interface
HNI	Head Neck Impactor
HNT	Horizontal Negative deviation from Target cell load
HOF	Height of Force
HPC	Head Performance Criterion
HPM	H-Point Manikin
HPS	Head Protection System
HPT	Head Protecting Technology
HRC	Time to head restraint first contact
HRMD	Head Restraint Measuring Device
HRV	Head Rebound Velocity
HTD	Hardest to detect
HV	High Voltage

I

IARV	Injury Assessment Reference Value
IBRL	Internal Bumper Reference Line
ICPL	Injury Criteria Protection Level
ICRT	International Consumer Research and Testing
IG	Informal Group
IHC	Intelligent Headlight Control
IHRA	International Harmonized Research Activities
IIHS	Insurance Institute for Highway Safety
IIWPG	International Insurance Whiplash Prevention Group
INRETS	Institut National de Recherche sur les Transports et leur Sécurité
INSIA	Instituto Universitario de Investigación del Automóvil
IP	Intersection Point
IRC	Injury Risk Curve
IRCOBI	International Research Council on the Biomechanics of Impact
IRF	Injury Risk Function
ISA	Intelligent Speed Assistance
ISM	Intelligent Speed Management
ISO	International Organization for Standardization
ISS	Injury Severity Score
ITC	Inland Transport Committee (UN ECE)

J

J-MLIT	Japan: Ministry of Land, Infrastructure and Transport
JAMA	Japan Automotive Manufacturers Association
JARI	Japan Automobile Research Institute
JASIC	Japan Automobile Standards Internationalization Center
JNCAP	Japan New Car Assessment Program

K

KMVSS	Korean Motor Vehicle Safety Standards
KNCAP	Korean New Car Assessment Program
KTH	Knee - Thigh - Hip

L

LDWS	Lane Departure Warning System
LHD	Left Hand Drive
LIDAR	Light Detection and Ranging
LIN	Local Interconnect Network
LINCAP	Lateral Impact New Car Assessment Program (U.S. NCAP)
LKAS	Lane Keeping Assist System
LKD	Lane Keeping Device
LKS	Lane Keeping System
LL	Lower Leg
LNL	Lower Neck Load
LSS	Lane Support System
LTR	Land Transport Rules (New Zeeland)

M

MAIS	Maximum AIS (Abbreviated Injury Scale)
MCL	Medial Collateral Ligament
MDB	Mobile Deformable Barrier
MOST	Media Oriented Systems Transport
MPDB	Moving Progressive Deformable Barrier
MSA	Manual Speed Assist
MTBI	Mild Traumatic Brain Injury
MVWG	Motor Vehicle Working Group (EU)

N

NASS	National Automotive Sampling System
NASS CDS	NASS Crashworthiness Data System
NASS GES	NASS General Estimates System
NASVA	National Agency for Automotive Safety & Victims' Aid (Japan)
NCAP	New Car Assessment Program
NCSA	National Center for Statistics and Analysis (an Office of NHTSA)
NHTSA	National Highway Traffic Safety Administration (USA)
NIC	Neck Injury Criterion
NNT	Number Needed to Treat
NPACS	New Programme for the Assessment of Child-restraint Systems
NPRM	Notice of Proposed Rule Making
NTSEL	National Traffic Safety and Environment Laboratory (Japan)

O

OC	Occipital Condyles
ODB	Offset Deformable Barrier

Important Abbreviations

OICA	Organisation Internationale des Constructeurs d'Automobiles
OLC	Occupant Load Criterion
OMDB	Oblique Moving Deformable Barrier
OoP	Out of Position

P

PADI	Procedures for the assembly disassembly and inspection
PAEB	Pedestrian Automatic Emergency Braking
PCL	Posterior Cruciate Ligament
PDB (1)	Partnership for Dummytechnology and Biomechanics
PDB (2)	Progressive Deformable Barrier
PDC	Park Distance Control
PDI	Pedestrian Detection Impactor
PEAS	Primary Energy Absorbing Structure
PLI	Pedestrian Legform Impactor
PMD	Photonic Mixer Device
PMHS	Post Mortem Human Subjects
PMTO	Post Mortal Test Object
PNCAP	Primary New Car Assessment Programme
PoC	Point of Collision
PP	Pedestrian Protection (Euro NCAP)
PPAD	Partner Protection Assessment Deformation
PSPF	Pubic Symphysis Peak Force
PTS	Poly Trauma Score

R

Radar	Radio Detection and Ranging
RCAR	Research Council for Automobile Repairs
RCTA	Rear Cross Traffic Alert
RE	Rib Extension (for EuroSID II)
RFCRS	Rearward Facing Child Restraint System
RHD	Right Hand Drive
RID	Rear Impact Dummy

S

S.O	Statutory Order
SA	Safety Assist (Euro NCAP)
SAE	Society of Automotive Engineers
SAS	Speed Assistance System
SAT	Safety Assist Technology
SB	Seat Back
SBR	Seat Belt Reminder
SCOE	Standing Committee on Implementation of Emission Legislation
SEAS	Secondary Energy Absorbing Structure
SgRP	Seating Reference Point
SID	Side Impact Dummy
SINCAP	Side Impact New Car Assessment Program (U.S. NCAP)
SLD	Speed Limitation Device
SLIF	Speed Limit Information Function
SMA	Shape Memory Alloy
SOB	Small Overlap Barrier (IIHS)
SRA	Swedish Road Administration
SRP	Seat Reference Point
SRS	Supplementary Restraint System
SSF	Static Stability Factor (U.S. NCAP)
SSR	Speed Sign Recognition
ST	Sensing Time
STATS19	British Accident Statistics
STNI	Soft Tissue Neck Injury
SUV	Sports Utility Vehicle
SWR	Strength-to-weight ratio (roof crush)

T

TCMV	Technical Committee - Motor Vehicles (EU)
TDM	Time Division Multiplex
TDMA	Time Division Multiple Access
TEG	Technical Evaluation Group
TF BTA	Task Force Bumper Test Area
ThCC	Thoracic Compression Criterion, also TCC
THOR	Test Device for Human Occupant Restraint
THUMS	Total Human Model for Safety
TIPT	Thorax Injury Prediction Tool
TREAD	Transportation Recall, Enhancement, Accountability and Documentation
TRL	Transport Research Laboratory (UK)
TRT	Total Reaction/Response Time
TSP	Top Safety Pick (IIHS)
TT	Top Tether
TTB	Time to Brake
TTC	Time to Collision
TTD	Time to Decision
TTI	Thoracic Trauma Index
TTP/A	Time-Triggered Protocol Class A
TTP/C	Time-Triggered Protocol Class C
TTS	Time to Steer

U

U.S. NCAP	United States New Car Assessment Program
UART	Universal Asynchronous Receiver Transmitter
UBM	Upper Body Mass
UMTRI	University of Michigan Transportation Research Institute
UN	United Nations
USCAR	The United States Council for Automotive Research

V

VAN	Vehicle Area Network
VC	Viscous Criterion
VDC	Vehicle Dynamics Control
VERPS	Vehicle Related Pedestrian Safety
vFSS	Advanced Forward Looking Safety Systems (Working Group)
VNT	Vertical Negative deviation from Target cell load
VR	Virtual Reality
VRTC	Vehicle Research & Test Center (NHTSA)
VRU	Vulnerable Road User
VSS	Vehicle Safety Score (U.S. NCAP)

W

WAD (1)	Wrap Around Distance
WAD (2)	Whiplash Associated Disorders
WG	Working Group
WP	Working Party
WPI	Worchester Polytechnic Institute
WS	World SID
WS5F	World SID 5th%ile Female Dummy
WSTC	Wayne State University Tolerance Curve
WSU	Wayne State University

Registration
You can register for seminars directly via our webpage www.carhs.de or send us the completed and signed registration form, by mail or fax. By signing the registration or by transmitting the e-mail/internet-registration the participant accepts the terms of participation. Your registration data are saved electronically for internal purposes.

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Immediately after receipt of the registration you obtain a written confirmation of registration and an invoice. Invoices need to be paid within 30 days from the issuing date of the invoice, however, not later than 7 days before the beginning of the seminar, without deductions. We reserve the right to exclude participants who have not paid in time from the participation in the seminar.

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Seminar Calendar 2017

January	February	March	April	May	June
1 Su New Year	1 We	1 We	1 Sa	1 Mo Labor Day	1 Th
2 Mo	2 Th	2 Th	2 Su	2 Tu	2 Fr
3 Tu	3 Fr	3 Fr	3 Mo	3 We	3 Sa
4 We	4 Sa	4 Sa	4 Tu Side Impact p.71	4 Th	4 Su Pentecost
5 Th	5 Su	5 Su	5 We automotive CAE Grand Challenge 2017 p.138	5 Fr	5 Mo Pentecost
6 Fr Epiphany	6 Mo Product Liability in the Automobile Industry p.55	6 Mo Introduction to Python Programming www	6 Th	6 Sa	6 Tu
7 Sa	7 Tu	7 Tu	7 Fr Autonomous Driving p.115	7 Su	7 We Side Impact p.71
8 Su	8 We Modeling of Joints www	8 We Cars in Low-Speed Crashes p.90	8 Sa	8 Mo Introduction t. Active Safety p.109	8 Th
9 Mo	9 Th Dummy Training Hybrid III p.104	9 Th Lightweight Design Summit / Safety + Crash Regulations p.16	9 Su	9 Tu Mat. Models of Metals	9 Fr
10 Tu	10 Fr	10 Fr	10 Mo	10 We Material Models of Plastics and Foams p.144	10 Sa
11 We	11 Sa	11 Sa	11 Tu	11 Th	11 Su
12 Th	12 Su	12 Su	12 We	12 Fr Mat. Models of Composites	12 Mo Head Impact
13 Fr	13 Mo Robust Design p.137	13 Mo Occupant Protection in Frontal Crashes www	13 Th	13 Sa	13 Tu Introduction to Passive Safety of Vehicles p.15
14 Sa	14 Tu	14 Tu	14 Fr Good Friday	14 Su	14 We
15 Su	15 We Structural Optimization / Frontal Restraints p.61	15 We	15 Sa	15 Mo	15 Th Corpus Christi
16 Mo	16 Th	16 Th Crashworthy Car Body Design p.58	16 Su Easter	16 Tu SAFETYWEEK DIE ZUKUNFT DER FAHRZEUGSICHERHEIT p.13	16 Fr
17 Tu	17 Fr Euro NCAP - Compact www	17 Fr	17 Mo Easter	17 We	17 Sa
18 We	18 Sa	18 Sa	18 Tu	18 Th	18 Su
19 Th	19 Su	19 Su	19 We	19 Fr	19 Mo Car Body Design for Analysis Engineers p.132
20 Fr	20 Mo Whiplash p.86	20 Mo NCAP / Active Safety p.118	20 Th	20 Sa	20 Tu
21 Sa	21 Tu Dummy Training Q6/Q10 p.104	21 Tu	21 Fr	21 Su	21 We
22 Su	22 We Certification Q-Dummies www	22 We Crash Safety of Alternative Propulsion Vehicles p.20	22 Sa	22 Mo	22 Th NCAP / Active Safety p.118
23 Mo	23 Th NVH - Background, Practice and Simulation www	23 Th	23 Su	23 Tu Product Liability in the Automobile Industry p.55	23 Fr
24 Tu	24 Fr	24 Fr Ejection Mitigation www	24 Mo Interior Development www	24 We	24 Sa
25 We	25 Sa	25 Sa	25 Tu Introd. Passive Safety p.15	25 Th Ascension of Christ	25 Su
26 Th	26 Su	26 Su	26 We Static Vehicle Safety Tests	26 Fr	26 Mo Crash Safety of Alternative Propulsion Vehicles p.20
27 Fr	27 Mo	27 Mo Lightweight Design Strategies for Car Bodies p.134	27 Th Introduction to Data Acquisition in Safety Testing p.94	27 Sa	27 Tu
28 Sa	28 Tu	28 Tu	28 Fr	28 Su	28 We 12th PraxisConference Pedestrian Protection p.76
29 Su		29 We Pedestrian Protection p.77	29 Sa	29 Mo Crashworthy Car Body Design p.58	29 Th
30 Mo		30 Th Design of Composite Structures www	30 Su	30 Tu	30 Fr Functional Safety www
31 Tu		31 Fr		31 We Pedestrian Protection p.77	

Course Venue Alzenau
Course Venue Würzburg
Course Venue Hanau
Course Venue Aschaffenburg
Course Venue Landsberg am Lech
Course Venue Bergisch Gladbach
Course Venue Gaimersheim/Ingolstadt

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Seminar Calendar 2017

July	August	September	October	November	December
1 Sa	1 Tu Automotive Safety Summit Shanghai 2017 p.93	1 Fr	1 Su	1 We All Saints	1 Fr
2 Su	2 We	2 Sa	2 Mo	2 Th NCAP / Passive Safety p.118	2 Sa
3 Mo Autonomous Driving, Advanced Driver Assistance p.115	3 Th	3 Su	3 Tu German National Holiday	3 Fr	3 Su
4 Tu	4 Fr	4 Mo Whiplash p.86	4 We Functional Safety ISO 26262 www	4 Sa	4 Mo Dummy Training THOR p.104
5 We	5 Sa	5 Tu Modeling of Joints www	5 Th	5 Su	5 Tu
6 Th	6 Su	6 We Introduction to Passive Safety of Vehicles p. 15	6 Fr Rear Seat Occupant Prot. p.66	6 Mo Crash Safety of Alternative Propulsion Vehicles p.20	6 We Dummy Certification Basics THOR www
7 Fr Ejection Mitigation www	7 Mo	7 Th	7 Sa	7 Tu	7 Th
8 Sa	8 Tu	8 Fr	8 Su	8 We Static Vehicle Safety Tests www	8 Fr
9 Su	9 We	9 Sa	9 Mo	9 Th Autonomous Driving, Advanced Driver Assistance p.115	9 Sa
10 Mo Development of Frontal Restraint Systems p.61	10 Th	10 Su	10 Tu Pedestrian Protection p.77	10 Fr	10 Su
11 Tu	11 Fr	11 Mo Knee Mapping Workshop p.32	11 We PraxisConference Crash Dummy p.100	11 Sa	11 Mo
12 We	12 Sa	12 Tu Crashworthy Car Body Des. p.58	12 Th	12 Su	12 Tu
13 Th	13 Su	13 We Robust Design p.137	13 Fr Child Protection www	13 Mo Car Body Design for Analysis Engineers p.132	13 We
14 Fr	14 Mo	14 Th International Safety and Crash-Test Regulations p.16	14 Sa	14 Tu	14 Th
15 Sa	15 Tu Assumption Day	15 Fr	15 Su	15 We PraxisConference Rear Impact-Seats-Whiplash www	15 Fr
16 Su	16 We	16 Sa	16 Mo Product Liability in the Automobile Industry p.55	16 Th	16 Sa
17 Mo	17 Th	17 Su	17 Tu	17 Fr Introd. to Active Safety p.109	17 Su
18 Tu	18 Fr	18 Mo Structural Optimization in Automotive Design www	18 We Cars in Low-Speed Crashes p.90	18 Sa	18 Mo
19 We	19 Sa	19 Tu	19 Th Introduction to Data Acquisition in Safety Testing p.94	19 Su	19 Tu
20 Th	20 Su	20 We Improving Efficiency and Reducing Risk in CAE www	20 Fr	20 Mo Introduction to Passive Safety of Vehicles p.15	20 We
21 Fr	21 Mo	21 Th	21 Sa	21 Tu	21 Th
22 Sa	22 Tu	22 Fr Commercial Vehicle Safety www	22 Su	22 We	22 Fr
23 Su	23 We	23 Sa	23 Mo Advanced Frontal Restraints www	23 Th Lightweight Design Strate-gies for Car Bodies p.134	23 Sa
24 Mo	24 Th	24 Su	24 Tu Material Models of Plastics and Foams p.144	24 Fr	24 Su Christmas Eve
25 Tu	25 Fr	25 Mo Interior Development www	25 We	25 Sa	25 Mo Christmas
26 We	26 Sa	26 Tu SafetyUpDate Graz2016 p.14	26 Th Mat. Models of Metals p.142	26 Su	26 Tu Christmas
27 Th	27 Su	27 We	27 Fr Mat. Mod. of Composites p.140	27 Mo Euro NCAP - Compact www	27 We
28 Fr	28 Mo	28 Th PraxisConference AEB p.121	28 Sa	28 Tu Side Impact p.71	28 Th
29 Sa	29 Tu	29 Fr	29 Su	29 We	29 Fr
30 Su	30 We	30 Sa	30 Mo	30 Th	30 Sa
31 Mo	31 Th		31 Tu		31 Su New Year's Eve

Course Venue Alzenau
Course Venue Bergisch Gladbach
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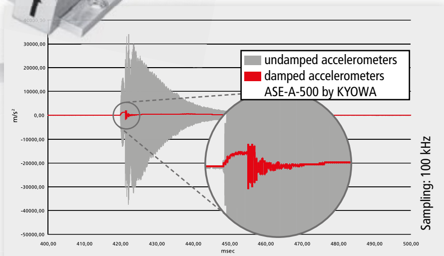
Compact Data Acquisition System for Automotive Crash Test – DIS-7000A

- A Crash Test Data Acquisition System with high impact resistance, realizing small size, lightweight.
- More than 1,000 sensors can be connected.
- Equipped with a large-capacity flash memory and lithium ion rechargeable battery
- By combining such as Airbag timer unit or CAN unit to the Master Module, systems which match the purpose of measurement can be realized.

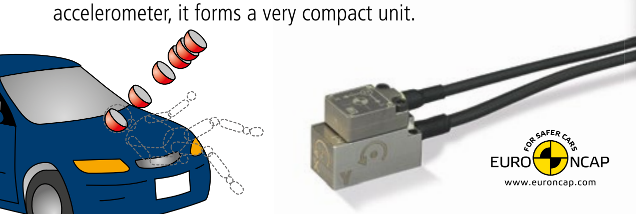
The compact 3-channel logger DIS-503A is suitable in the head impactor or child dummies

Crash Test Transducers

Euro NCAP requires damped accelerometers for tests in pedestrian protection. The **oil-damped Kyowa transducers** are the perfect drop-in replacement for old, undamped accelerometers. The advantage of these accelerometers over their undamped counterparts is that excessive peaks in the measurement output signal near the upper frequency limit are almost completely excluded. The new **angular rate gyro GSAT-A-900** can be operated connected to any crash data recorder. Mounted together with the ASE-A type accelerometer, it forms a very compact unit.



When using a damped accelerometer, such as the ASE-A series, there is no high resonant vibration during impact tests on the windscreen and the bonnet, in contrast to the undamped accelerometer.



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Messe Stuttgart

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