

Information on the implementation of RCAR crash standards in the German insurance vehicle rating system and information on AEB systems

Revision 3, September 2016

As an RCAR member in Germany, AZT ist often contacted for information on German type class rating and the implementation of RCAR tests in this rating procedure. Herewith AZT wants to provide this information in a concentrated form at a central access point.

Background

The German type class rating is used to evaluate the insurer's claims costs in order to estimate the specific risk of a particular passenger vehicle in the German market. It is not a specification of premiums. However, most insurers rely on the type class as a basis of their individual calculation of premiums.

The process is prepared by the German Insurers Association (GDV) and finalized by a commission under the lead of an independent trustee. The preparation includes a technical evaluation of the vehicle's repair friendliness and its ability to interact with an opponent. GDV has published the respective information for the procedure, the implementation of the bumper test and additional information on lower load pathes over the last years. An additional paper describes the consideration of AEB systems at the initial classification procedure.

With courtesy of GDV the named documents are provided in the following.

1. Description of Group Rating System, Issue April 2011
2. Amendment to 1. : Revised CCKW method on top of the type damage calculation issue July 2016
3. Documentation scheme of Bumper Test results
4. Statement „Use of the Lower Loadpath“, Issue January 2014
5. Consideration of AEB systems at the initial classification procedure

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Information on the implimentation of RCAR crash standards in the German insurance vehicle rating system and information on AEB systems

Document 1

Description of Group Rating System
issue April 2011 by GDV

Rating system of passenger cars in German motor insurance

(Full and partial comprehensive coverage,
third party liability)
(Status: 04/11)

1. Type class lists, trustee and classification committee

The type class lists for third party liability, full and partial car comprehensive insurance are kept by an independent trustee, PricewaterhouseCoopers AG Wirtschaftsprüfungsgesellschaft. The trustee is advised by a classification committee to which delegates of the German federal office for motor transport (KBA), the German insurance association (GDV) as well as technical experts and consultants from the insurance industry belong. Suggestions for the classification of a new or reclassification of an existing auto model are put forward by GDV (i.e. the German insurance association), submitted to the trustee for examination and subsequently discussed with the classification committee. On the basis of this consultation process the trustee implements these classifications and/or reclassifications of car models.

The type class lists are drawn up by the trustee on the 1st of October of every year. The German insurance association (GDV) sends a circular containing the type class lists to the insurance companies and at the same time places the updated type classes in the Internet (www.gdv.de). In the preceding annual examination the model categories of all vehicles are checked on the basis of the newest GDV statistics to see whether the current classifications based on the cost of claims are still warranted or whether reclassifications ought to take place as a result of changes in the claims costs.

In full and partial comprehensive coverage the classifications of new vehicle models, which take place several times every year, are also immediately passed on to the insurance companies by the GDV in the form of supplements to the latest type class lists. This information is also placed in the Internet.

2. Type classification of the full and partial comprehensive coverage

The existing structure in motor insurance was initially recommended to insurance companies on 18.9.2002 in the form of studies. Among other things the studies describe the procedures for establishing the risk-premium index of each vehicle type, for creating type classes as well as for the initial classification of new vehicles types.

2.1 Type classification

The model categories or classes as well as their index limits were established by statistical means (iterative minimum variance analysis) in both the new full and new partial comprehensive coverage. This resulted in 25 model categories in full comprehensive coverage (Appendix 1) and 24 model categories in partial comprehensive coverage (Appendix 2). The index limits as well as the range of model categories are different in full and partial coverage.

The classification into the individual model categories is based on the risk premium (RP) of the relevant vehicle type. This RP value is expressed in index points. A range of index points is allocated to each model category. If the upper or lower limits of this range is transgressed a reclassification of the model category takes place.

2.2 Formation of design groups

All models which are categorized by the European Type approval procedure (2007/46/EG) as M1 or M1G (passenger car / off-road passenger car) are described by a combination of manufacturer and model identification numbers (HSN/TSN) issued by the federal office for motor transport (KBA).

Among the numerous vehicle types there are many models similar in design, but they may differ in their performance figures. In full and partial comprehensive coverage these vehicle types can be combined into various design groups. The composition of the design groups in full and partial comprehensive may be different.

2.3 Classification procedure

If a new vehicle type can be allocated to an existing design group, e.g. a variant of an existing model series, the variant assumes the risk premium index of this design group. For vehicle types which cannot be allocated to a design group and for vehicle types of a completely new model series, by contrast, one or more new design groups are established. The index values for claims frequency, claims average or risk premium will be ascertained anew.

2.3.1 Full comprehensive coverage

In full comprehensive coverage the classification of new models or vehicle types which cannot be allocated to a design group takes place on the basis of the risk premium index (RP_{Index}) which is derived at by multiplying the claims frequency index (CF_{Index}) by the claims average index (CA_{Index}), divided by 100.

The index CA is derived from the ratio of the claims average of the model to be classified ($CA_{Individual}$) to the claims average of all market models (CA_{Total}), multiplied by 100. The index CF is derived from the ratio of the claims frequency of the individual model ($CF_{Individual}$) to the claims frequency of all market models (CF_{Total}), again multiplied by 100.

Thus the basic formula for the calculation is as follows:

$$RP_{Index} = \left\{ \text{Index} \left(\frac{CA_{Individual}}{CA_{Total}} * 100 \right) * \text{Index} \left(\frac{CF_{Individual}}{CF_{Total}} * 100 \right) \right\} / 100$$

Through the reference to the average of all market models the difference between the calculated index figure for claims average and claims frequency and the average of 100 shows by what percentage the model being classified is above or under the overall average of all models in terms of claims average and claims frequency.

The CF value is constituted by the relevant index value of the previous model and/or the CF medium value of relevant comparable models from other manufacturers from the GDV model statistics. The lower claims frequency of new vehicles, which has been statistically proven, is taken into account through a percentage reduction, calculated annually, of the claims frequency of the model to be classified.

Since no CA value is available for new models, it is determined in accordance with the so-called model damage calculation (TSB). To be able to also take into account the influence of the driving power (P) on the average repair costs within a particular model series, the claims index CA_{TSB} of the model series will be extended for each vehicle type by one component as a function of the driving power (CA_{kW}).

$$\text{Index CA} = \text{Index CA}_{TSB} + \text{Index CA}_{kW}$$

$$\text{where Index CA}_{kW} = 0,1 * P \text{ (kW)} + 5,7$$

Note: changes applied to this formula, see document 2

This consists of the weighted repair costs for typified damage to the front, side and rear which, with a share of 54 % for front damage, 30 % for rear damage and 16 % for side damage, forms the basis of the initial classification in the model damage method. The claims settlement costs incurred as a result of the actual loss adjustment are taken into account by means of an annually adjusted percentage surcharge on the claim average CA_{TSB} of the model to be classified.

In this calculation method not only the price of spare parts, but also the working times are important for repairing the damage. The shorter the repair times and the less material (spare parts and paints) necessary, i.e. the more repair-friendly the design of the model, the lower the model damage calculation, the claims average index of the model and thus also the initial model category classification. This method of calculation allows the manufacturer to achieve a favourable classification for full comprehensive coverage by designing the vehicle as repair-friendly as possible.

A crash repair test (RCAR 15 km/h 10°¹) to be carried out by the manufacturer should form the basis of the front and rear damage (Appendices 3 and 4). If there is no crash repair test available, the calculation is made on theoretical basis. For the side damage a theoretical damage is assumed whose essential components are a sectional repair of the driver's door sill as well as the renewal of the driver's door.

Since January 1st 2010, the results of the RCAR Bumper Test Procedure (Appendix 5) are considered within the classification formula in order to evaluate the performance of the bumper system closer to reality. The front and rear bumper tests are based on the RCAR bumper test paper² and supplementary the comments of

¹ The Procedure for Conducting a Low Speed 15 km/h Offset Insurance Crash test to Determine the Damageability and Repairability Features of Motor Vehicle, Issue 2.1 :September 2006 (http://www.rcar.org/Papers/Procedures/rcar_test_protocol_angle_barrier.pdf)

² RCAR Bumper Test; Issue 2.00 September 2010 including Appendix 1 „Dimensions and Specifications of the RCAR Bumper Barrier System“ (<http://www.rcar.org/Papers/Procedures/BumperTestProcedure.pdf>)

GDV³. If the car is complying with the requirements of the bumper test, the result of the type damage calculation, based on the RCAR 10° structural test, remains unchanged. If not, the result of the type damage calculation will be increased by one type class each for the front and rear test independently. For this reason, the index risk premium (RP) and claims average (CA) will be recalculated in order to fit with the new resulting type class. Therefore the maximum influence of the bumper test is limited by +2 type classes.

In the case of special high performance variants of a model series or variants fitted with high price parts, the CA value is ascertained according to the so-called high-price/high-performance method. A surcharge allowing for the increased risk premium of such models is placed on the CA value of the basic model commensurate with the ratio of the sales price of the high-price/high-performance model to be classified to the sales price of the basic model.

The model category calculation is commissioned by the trustee and carried out several months prior to the new model coming onto the market by representatives of the German insurance association (GDV) in close collaboration with the vehicle manufacturers or importers.

2.3.2 Partial comprehensive coverage

Since no comparable model claims calculation is possible, the initial classification in partial comprehensive coverage insurance is based on a similar previous model's risk premium index borne out by statistics. If no comparable previous model with statistical data exists, the risk premium index figures of one or more comparable competitor models of the same or a different manufacturer are normally used - either alone or in addition - to establish a medium value.

³ Integration of the RCAR Bumper Tests into the initial rating procedure used by the German motor insurance industry for fully comprehensive vehicle insurance

2.4 Reclassification procedure

Classifications are reviewed annually based on the GDV model statistics of the previous year. To widen the statistical basis and to be able to counter coincidental influences, the review includes the last three statistical years. The result is published in an up-dated model category index on 1 October each year.

2.4.1 Full comprehensive coverage

Reclassification in full comprehensive coverage takes place if the current statistical values of the design group's CF Index and CA Index have increased or decreased in relation to the initial or the previous year's classification and the RP Index of the design group has consequently exceeded or dropped below the points limit for the next model category. The single model's CA Index, which is derived at through the model damage calculation method, is examined only if the relevant design group has a minimum of 7300 annual units⁴. At least 2800 annual units are necessary for the examination of the CF Index.

If there is no statistical certainty for the CF or CA index values due to the fact that 2800 and 7300 annual units respectively have not yet been reached or have again dropped below the limit, a credibility procedure will be used to establish the claims frequency index value CF or the claims average index value CA.

In this credibility procedure the index value CF or CA is a weighted average which is calculated from the index value of the initial classification on the one hand and the statistical index value on the other in accordance with the formula below (for the CF Index).

$$CF_{cred} = CF_{stat} * \sqrt{\frac{AU}{AU_{total}}} + CF_{ic} * \left(1 - \sqrt{\frac{AU}{AU_{total}}} \right)$$

Key: CF_{cred} : credibility claims frequency index
 CF_{stat} : statistical claims frequency index
 CF_{ic} : claims frequency index of initial classification
AU : number of annual units of vehicle type
 AU_{total} : statistically ascertained limit of annual units of respective index value

2.4.2 Partial comprehensive coverage

The risk premium values of initial classifications in partial comprehensive coverage are examined if a minimum of 8100 annual units exist. Here too a credibility procedure is used if the number of units has not yet reached the annual limit or has fallen below it again (cf. 2.4.1).

3. The model category classification of Third Party Liability insurance

3.1 Type classification

Since July 1996, on the basis of the non-binding risk premium rate of the GDV, the third party liability premium of a vehicle type is no longer determined according to 11 kW (Kilowatt) categories etc., but, similar to auto insurance, according to the risk premium index of the relevant vehicle type. The 16 model categories of third party liability insurance as well as their index limits (Appendix 6) were determined through statistical methods (iterative minimum variance analysis).

3.2 Establishment of design groups

In third party liability insurance too, similarly constructed vehicle models can be combined in design groups (refer also to item 2.2). The combination of design groups in third party liability insurance can differ from those in full or in partial comprehensive.

3.3 Initial classification procedure

If a new vehicle type can be allocated to an existing design group, it adopts the risk premium index of this design group. If, on the other hand, a new model or a new vehicle type forms its own design group, risk premium index values borne out by statistics of previous and/or comparable models will be adopted.

3.4 Reclassification procedure

The allocation of design groups to the individual model categories is reviewed annually, based on the updated GDV model statistics. If any changes appear in the

⁴ An annual unit (AU) is equivalent to a vehicle insured for the period of one year. (1st of January until 31st of December).

risk premium index so that the points limit to the next highest or lowest model category is transgressed, appropriate reclassifications will be made. To widen the statistical basis and to be able to counter random factors, the last three statistical years are used as a basis.

In third party liability insurance the risk premium index values can be assumed to have a sound statistical basis if 11000 annual units have been reached in a design group. If no sound statistical basis for the risk premium index values exists because of annual units having not yet reached 11000 or having again dropped below that number, a credibility method will be used to determine the risk premium index value (cf. 2.4.1).

The classification results are published in a model category index that is updated annually by 1 October.

Hamburg, 13.04.2011

Trustee and classification committee

Appendix 1: Index points of the type classes for the new full coverage

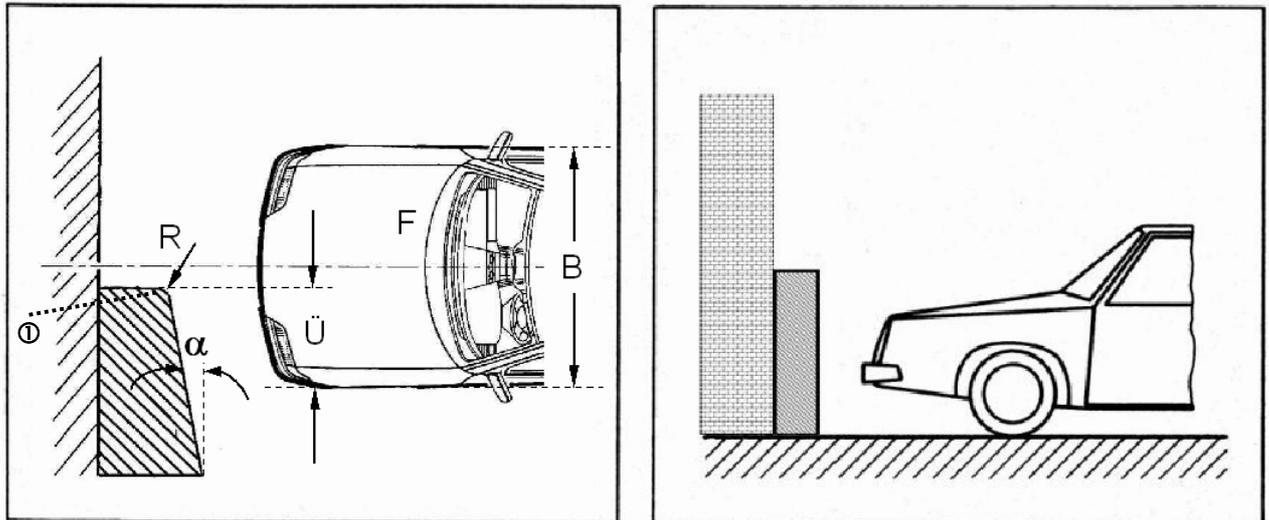
<u>Type class</u>	<u>Type class limits</u>	
10	up to	39,4
11	39,5	53,0
12	53,1	62,6
13	62,7	68,9
14	69,0	74,2
15	74,3	80,1
16	80,2	88,2
17	88,3	96,7
18	96,8	105,4
19	105,5	116,4
20	116,5	125,1
21	125,2	135,8
22	135,9	145,2
23	145,3	156,1
24	156,2	169,5
25	169,6	184,2
26	184,3	206,2
27	206,3	232,2
28	232,3	276,3
29	276,4	330,0
30	330,1	377,4
31	377,5	438,6
32	438,7	516,5
33	516,6	696,6
34	more than	696,7

Appendix 2: Index points of the type classes for the new partial coverage

<u>Type class</u>	<u>Type class limits</u>	
10	up to	36,3
11	36,4	47,4
12	47,5	56,2
13	56,3	65,2
14	65,3	75,1
15	75,2	87,4
16	87,5	97,1
17	97,2	109,6
18	109,7	122,1
19	122,2	133,5
20	133,6	147,7
21	147,8	166,3
22	166,4	183,5
23	183,6	210,8
24	210,9	241,6
25	241,7	271,7
26	271,8	306,6
27	306,7	354,8
28	354,9	416,4
29	416,5	486,9
30	487,0	628,7
31	628,8	763,8
32	763,9	975,4
33	more than	975,5

Appendix 3: Front crash test for the calculation of the type classes

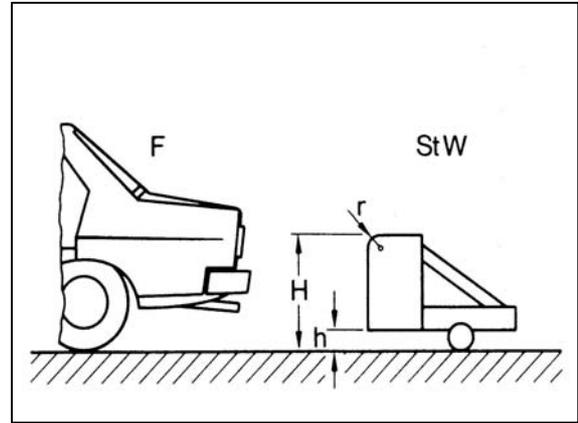
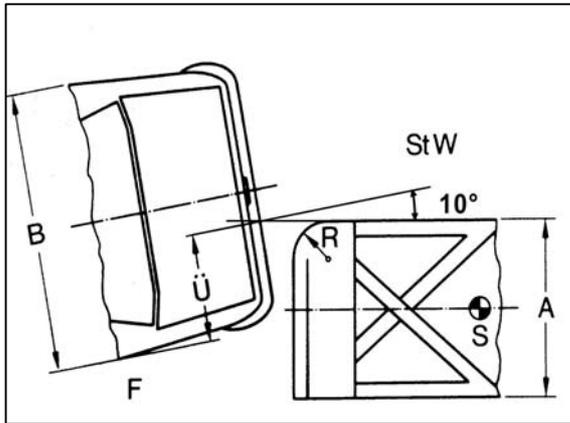
(AZT Automotive GmbH, Allianz Zentrum für Technik)



Test arrangement	The front of the vehicle is driven against a rigid angular barrier with an overlap of 40% on the driver's side. Test houses may decide to test the other side of the car, if appropriate
Referent width Overlap	B = Vehicle width without mirrors Ü = 0,40 x B
Vehicle	F = Vehicle
Condition	Free of any exterior or propelling force at the moment of impact Serviceable, battery connected, ignition „on“. Safety equipment (belt pretensioner, airbags) in function. Air conditioning system drained and pressure checked. Brakes released, gear lever in neutral position
Load	1 Dummy, 50% male, driving position, secured with seat belt Fuel tank filled with petrol or diesel, water also permissible
Measurements	Axle alignment and body gaps checked before and after impact. Body alignment checked before and after impact. Actual vehicle's mass in test configuration. Vehicle acceleration on left and right sill (base of the "B" post)
Barrier dimensions	
Barrier Angle	$\alpha = 10^\circ$ (also permissible at short barrier surface -⊖-)
Height	Barrier clearly higher than the vehicle front
Depth	No contact of the vehicle front with the wall adjacent to the barrier
Rounding	R = 150 mm
Impact speed	$V_F = 15,0 \text{ km/h } (+1/-0 \text{ km/h})$
Remark:	The front door on the impacted side shall be opened completely after the crash test.

Appendix 4: Rear crash test for the calculation of type classes

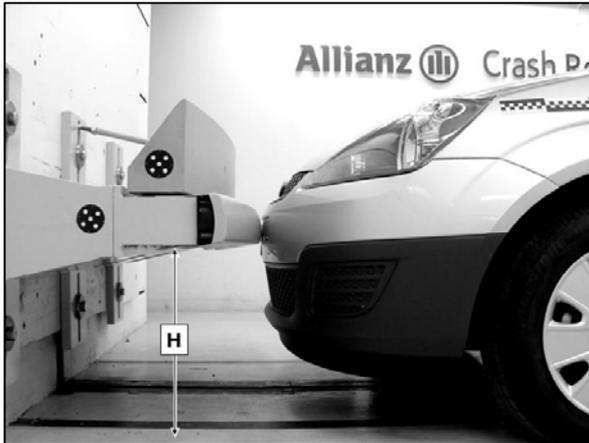
(AZT Automotive GmbH, Allianz Zentrum für Technik)



Test arrangement	The rear is impacted by a mobile barrier on the driver`s side with an overlap of 40%. Test houses may decide to test the other side of the car, if appropriate
Referent width Overlap	B = Vehicle width without mirrors Ü = 0,40 x B
Vehicle	F = Vehicle
Condition	Free of any exterior or propelling force at the moment of impact Serviceable, battery connected, ignition „on“. Safety equipment (belt pretensioner, airbags) in function. Stationary, brakes released, gear lever in neutral position
Load	1 Dummy, 50% male, driving position, secured with seat belt. Fuel tank filled with petrol or diesel, water also permissible
Measurements	Axle alignment and body gaps checked before and after impact. Body alignment checked before and after impact Actual vehicle`s mass in test configuration Vehicle acceleration on left and right sill (base of the “B” post)
Mobile barrier	StW = Mobile barrier
Mass	Free of any exterior or propelling force at the moment of impact $m_{StW} = 1.400 \text{ kg}$, center of gravity “S” in the middle plane
Sled dimensions	Wheel base $Y \geq 1,5 \text{ m}$ Width $A \geq 1,2 \text{ m}$
Barrier dimensions	
Height	H = 700 mm
Lower edge	h = 200 mm
Rounding	R = 150 mm r = 50 mm
Impact speed	$V_{StW} = 15,0 \text{ km/h } (+1/-0 \text{ km/h})$

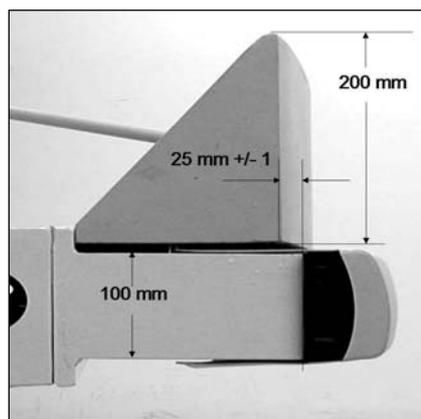
Anlage 5: RCAR Bumpertest

AZT (RCAR) Bumper Test Front/ Rear



Main test parameter:

- Test arrangement: Vehicle impact on a rigid bumper barrier with energy absorbing element
Centerline of the car aligned with centerline of the barrier (+/- 50 mm)
- Vehicle ride height: at construction level as defined by the manufacturer (+/- 10 mm)
(Test houses may decide to test the vehicle „as delivered“)
- Condition and load: Tire pressure: standard, vehicle serviceable, battery connected
Tank filled with fuel or water (>90%)
1 Dummy 75 ± 5 kg (e.g. 50% male) in driver position, secured with seat belt
- Barrier ground clearance: **Front crash H = 455 mm (+/- 3 mm)**
Rear crash H = 405 or 455 mm (+/- 3 mm) (depending on local market)
- Impact speed: **V = 10.0 km/h (+/-0.5 km/h)**



Appendix 6: Index points of the type classes for the third party liability

<u>Type class</u>	Type class limits	
10	up to	49,4
11	49,5	61,8
12	61,9	71,5
13	71,6	79,7
14	79,8	86,5
15	86,6	91,9
16	92,0	97,6
17	97,7	103,6
18	103,7	110,3
19	110,4	117,9
20	118,0	125,3
21	125,4	133,2
22	133,3	143,9
23	144,0	165,3
24	165,4	195,9
25	more than	196,0

Information on the implimentation of RCAR crash standards in the German insurance vehicle rating system and information on AEB systems

Document 2

Description of Group Rating System
issue April 2011 by GDV

Amendment:

Revised CCKW method on top of the type damage calculation
issue July 2016 by GDV

Vorgehen SB-Verfahren bei der Typschadenberechnung: ab 188.KK (Juli 2016)

1. Aus der normalen Typschadenberechnungen resultieren die Indexwerte SH_{TSB} , SD_{TSB} , SB_{TSB} und die zugeordnete vorläufige Typklasse. (TKL_{TSB})
2. Der resultierende SB-Indexwert wird mit folgendem additiven Zuschlag versehen:

$$SB_{kW} = 0,2 * [kW] + 5$$

3. Diese Typklasse wird, soweit erforderlich, um die Ergebnisse des Bumpertests korrigiert.
(SD_{TSBnB} ; SB_{TSBnB} ; TKL_{TSBnB})
4. Wie bisher (seit 178.KK): Der für die neue Typklasse maßgebende SB-Index ermittelt sich nach der Formel: $SB_{AW} = SB_{TSBnB} + SB_{kW}$
5. Wie bisher (seit 178.KK): Die für das Credibilityverfahren notwendigen neuen AW-Werte für den SH- und SD-Index berechnen sich dann wie folgt:

$$SH_{AW} = SH_{TSB} * (1 + SB_{kW} / SB_{TSBnB})^{0,5}$$

$$SD_{AW} = SD_{TSBnB} * (1 + SB_{kW} / SB_{TSBnB})^{0,5}$$

New CC_{kW} method on top of the type damage calculation: from 188.KK (July 2016)

1. As a result of the normal type damage calculation (TDC) we receive the index values claims-frequency CF_{TDC} , claims-average CA_{TDC} and claims-cost CC_{TDC} and the preliminary type-class (TKL_{TDC}).
2. The CC-index resulting of the type damage calculation will be added with surcharge CC_{kW} as follows:

$$CC_{kW} = 0,2 * [kW] + 5$$

3. If necessary this type-class will be adjusted by the result of the bumper test (including bumper: iB) (CA_{TDCiB} ; CC_{TDCiB} ; TKL_{TDCiB})
4. As before (178.KK): The CC-index, authoritative for the resulting type class is calculated as follows:
 $CC_{AW} = CC_{TDCiB} + CC_{kW}$
5. As before (178.KK): The new index values CF_{AW} and CA_{AW} , necessary for the statistics, are calculated by the following formulars:

$$CF_{AW} = CF_{TDC} * (1 + CC_{kW} / CC_{TDCiB})^{0,5}$$

$$CA_{AW} = CA_{TDCiB} * (1 + CC_{kW} / CC_{TDCiB})^{0,5}$$



Information on the implimentation of RCAR crash standards in the German insurance vehicle rating system and information on AEB systems

Document 3

Role of the RCAR Bumpertest
Issue Nov 09, by GDV

**Integration of the
RCAR bumper tests
into the initial rating procedure
used by the German motor insurance industry
for fully comprehensive vehicle insurance**

Issue November 2009

0. Introduction

The classification commission of the German motor insurers sees the RCAR bumper test as a suitable method for assessing how well a vehicle's bumper system protects the vehicle from damage in low-speed impacts in real-world crashes. The goal is to encourage vehicle manufacturers to further improve the level of self-protection of passenger cars and to increase the vehicles' geometric compatibility in collisions.

The RCAR bumper test is a necessary complement to the current RCAR 10° structural test necessary to avoid undesirable developments in the bumper system, such as too small or too weak bumper beam or even no bumper beam at all.

The amended rating procedure is based on the RCAR paper "RCAR Bumper Test" of November 2008, Issue 1.02 and Appendix 1 "Dimensions and Specifications of the RCAR Bumper Barrier System" of September 2007, Issue 1, with the following additions and explanations.

1. Application

The RCAR bumper test will be used in addition to the RCAR 10° structural test in determining the initial classification of new cars into the comprehensive insurance type classification system as of 01 January 2010. Vehicles, which will be rated in the November 2009 meeting (last rating meeting without RCAR bumper test), will have to be launched on the market by 31 March 2010. This means that these vehicles must be available for delivery to the end user and ready for registration and use by the end user.

During the transition period, variants of model series (e.g. body variants or engine variants) that were rated before 01 January 2010 without the bumper test will likewise be rated without the bumper test.

The RCAR bumper test will be used for all vehicles, which are homologated as passenger cars in the European type approval procedure (M1 or M1G) and listed in the type classification list.

2. Requirements

In order to pass the bumper test, a vehicle must fulfill the requirements in 2.1 through 2.3 below for both the front and the rear bumper test:

2.1 Geometric requirements

- a) The relevant bumper engagement of the bumper beam with the barrier must be ≥ 75 mm (see section 5.7, fig. 5, and sections 5.3 and 5.4 of the RCAR paper). For the German market, the relevant position of the barrier is that described in section 6.1 of the RCAR paper, with a barrier ground clearance of 455 mm for frontal impacts, and 405 mm for rear impacts.

Alternatively:

- b) In cases where the relevant bumper engagement is ≤ 75 mm, but a positive test result is expected, the qualifying bumper beam height shall be ≥ 100 mm (see section 5.1 of the RCAR paper).

2.2 Dynamic test

When the vehicle collides with the barrier, the vehicle/bumper beam must not underride or override the barrier, with the barrier subsequently intruding into the vehicle above or below the bumper beam. A purely vertical movement of the test vehicle along the barrier without subsequent forward movement is acceptable.

2.3 Damages to vehicle following the test

- a) Front impact test:

- No damage to the vehicle structure: The vehicle structure includes, in particular, the main chassis members as well as any parts or panels welded to the vehicle (e.g. radiator grill/front grill, crash boxes). Any change in the position of the main chassis members by more than ± 3 mm (tolerance, measurement before and after the test) is considered damage. Components/panels that, for assembly-related reasons, are welded on at a few welding points but are installed with screws/bolts in case of a repair, are not considered welded parts.
- No damage to cooling package, consisting of intercooler, A/C and radiator. Damage to fastening elements of the cooling packages or individual elements thereof is acceptable if it can be repaired using screw-on replacement fasteners.

- b) Rear impact test:

- No damage to the vehicle structure: The vehicle structure includes, in particular, the main chassis members as well as any parts or panels welded to the vehicle (e.g. rear end panel, floor panel, etc.).
- No damage to the boot lid or tailgate caused directly by the barrier. Indirect damage, caused for instance by wrinkling of the bumper cover, is tolerated.

3. Effect on the initial rating of vehicles for fully comprehensive insurance

The RCAR bumper test is introduced only in the initial rating procedure for fully comprehensive insurance, as a complement to the RCAR 10° structural test. If the vehicle fulfills the bumper test requirements set forth in section 2 above, the result of the type damage calculation from the RCAR 10° structural test will be used without any changes. If the test requirements are not fulfilled, the result of the type damage calculation from the RCAR 10° structural test is increased by one type class each for the front impact and the rear impact tests. Therefore, the impact of the bumper test is limited to a maximum of +2 type classes.

4. Test vehicle

The test vehicle must be the variant with the largest projected sales volume of the model series to be rated. The ride height of the test vehicles differs from the nominal ride height of the vehicle by maximum +/- 10 mm, as specified by the manufacturer (see section 4.0 of the RCAR paper). If different suspension setups are available, the standard suspension setup is to be used. The test vehicle must be fitted with air-conditioning. For vehicles with adjustable body height (e.g. in case of air suspension), the vehicle must be set to normal position at city speed (50 km/h).

Where, in case of variants with charged engines, an intercooler must be taken into account, these variants shall be assessed separately based on the remaining clearances between the bumper beam and the AC condenser. Body variants within a model series, which have a different nominal ride height (i. e. Coupes) will be assessed separate also. The vehicle manufacturer may perform simulations or additional tests to be on the safe side.

5. Presentation of the test results

The GDV will inspect the test results either directly on the crash vehicle or through detailed photo/video documentation of the test. In this case, the test vehicle can be repaired and reused for the RCAR 10° structural test. Specifically, the following points must be documented in an adequate manner:

- Design height (nominal ride height) of the test vehicle under test conditions as specified by the manufacturer.
- Actual ride height of the test vehicle under test conditions (photo of the measurement)
- Qualifying bumper beam height (see sections 5.2 through 5.4 of the RCAR paper)
- Relevant bumper engagement with the barrier (see section 5.7 of the RCAR paper; photo showing the test vehicle with removed bumper cover face-to-face with the barrier, including photographic documentation of the measurement)
- Video footage of the bumper test in side view (y axis) and top view (z axis) allowing to assess override/underride.
- Logs detailing the measurements of the vehicle structure (underbody) before and after the crash test (e.g. crash boxes left and right, or other suitable points, as well as at least two additional points along the x axis of the main chassis members). If the same vehicle is used for the 10° structural test, the post-measurements of the bumper test can be used as pre-measurements for the 10° structural test.
- Gap measurements before and after the crash.
- Documentation of damaged/undamaged vehicle parts (see section 2.3) before and after the crash with meaningful photos.

Information on the implimentation of RCAR crash standards in the German insurance vehicle rating system and information on AEB systems

Document 4

Documentation scheme of Bumper Test results
Issue Nov 09, by GDV

Documentation of RCAR Bumper Test Result

- References:**
- RCAR Bumper Test Procedure Issue 1.02 - November 2008
 - Appendix 1: Dimensions and Specifications of the RCAR Bumper Barrier System Issue 1 – September 2007
 - Integration of the RCAR Bumper Tests into the initial rating procedure of the full comprehensive coverage of the German motor insurance (GDV paper RCAR Bumper Test Version November 2009)

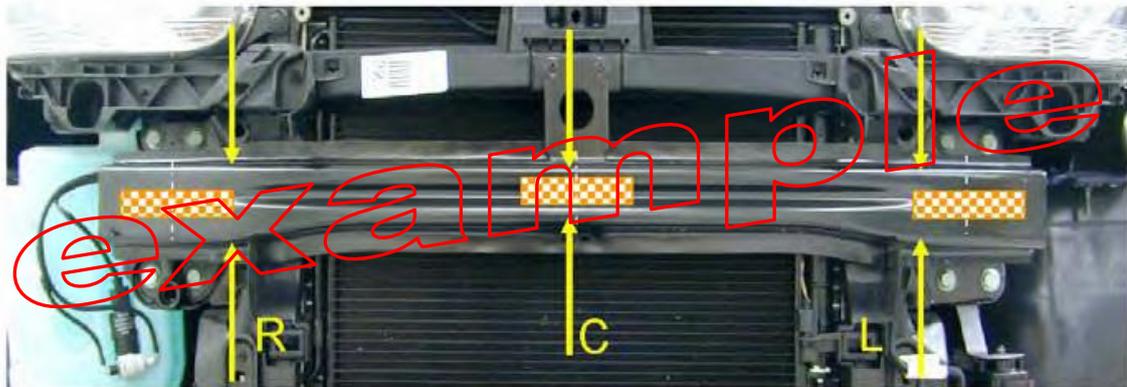
Vehicle Data:

Manufacturer:	
Modelname:	
Type:	
Version:	
Number of doors:	
Chassis suspension:	
Enginepower [kW]:	
Displacement:	
Fuel type:	
Drive:	
Vehicle nominal ride height	Nominal dimension incl. measure point
Test vehicle ride height	Picture documentation of measurement

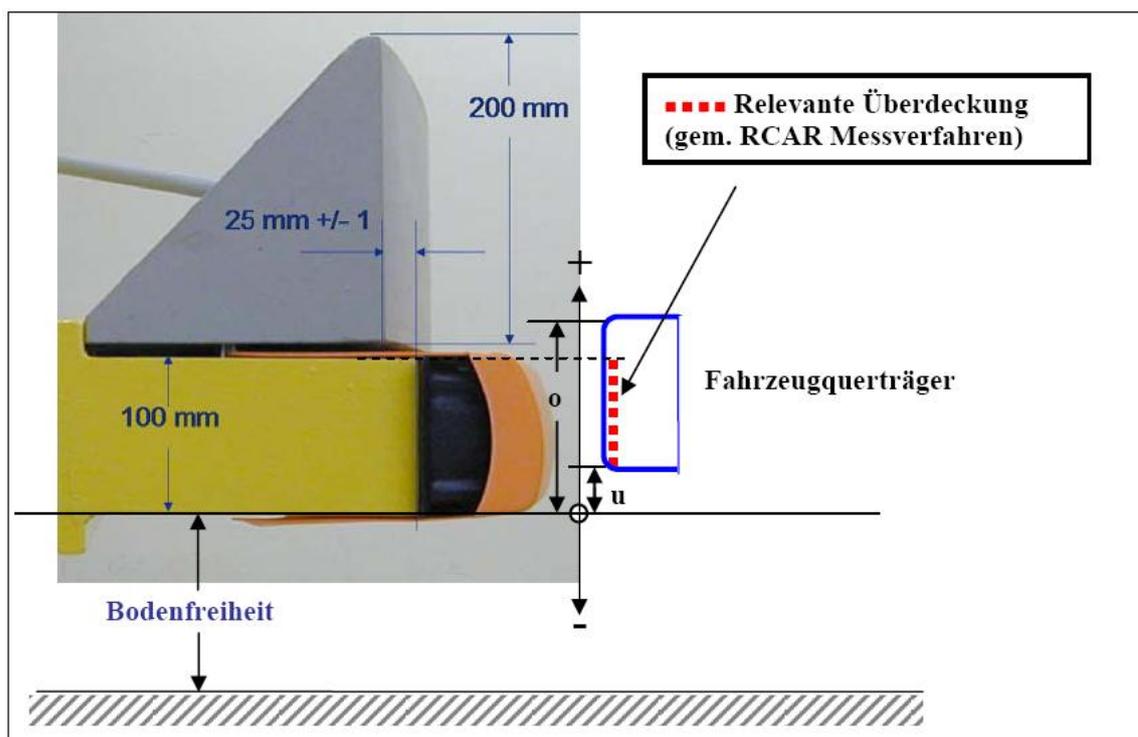
Front test: crash weight incl. Dummy [kg]	
Front test: crash speed [km/h]	
Rear test: crash weight incl. Dummy & if applicable free wheel support [kg]	
Rear test: crash speed [km/h]	

Bumper beam front:

Drawing or picture of bumper beam:



Bumper beam height measuring point right [mm]:	
Bumper beam height measuring point center [mm]:	
Bumper beam height measuring point left [mm]:	
Qualifying bumper beam height per RCAR [mm]:	
Barrier ground clearance [mm]:	
Position bumper beam to barrier bottom edge (u) Measuring point right / center / left [mm]:	
Position bumper beam to barrier top edge (o) Measuring point right / center / left [mm]:	
Relevant engagement of bumper beam RCAR [mm]:	



Measurements before & after impact

- Body gaps fender / front door LH and RH
- Side member LH & RH at side member flange and min. 2 other measuring points in x-direction (unstressed condition)

During testing:

- Lineup with & without bumper cover (fascia)



- Video documentation side (y-direction) & top view (z-direction)
Remarks: - Display detail side view: Front incl. front wheel
 - Front wheel mark with white dot on tyre wall
 - Display detail top view: complete vehicle width incl. windscreen bottom edge
- Measurement of vehicle deceleration in x- and z-direction at RH or LH side member behind flange to establish path of vehicle structure with 2-time integration
- Judgement of override/under ride based on video and path.
Criteria: Vertical movement of test vehicle during forward motion must be smaller than relevant engagement as per RCAR.

Documentation of damage after impact:

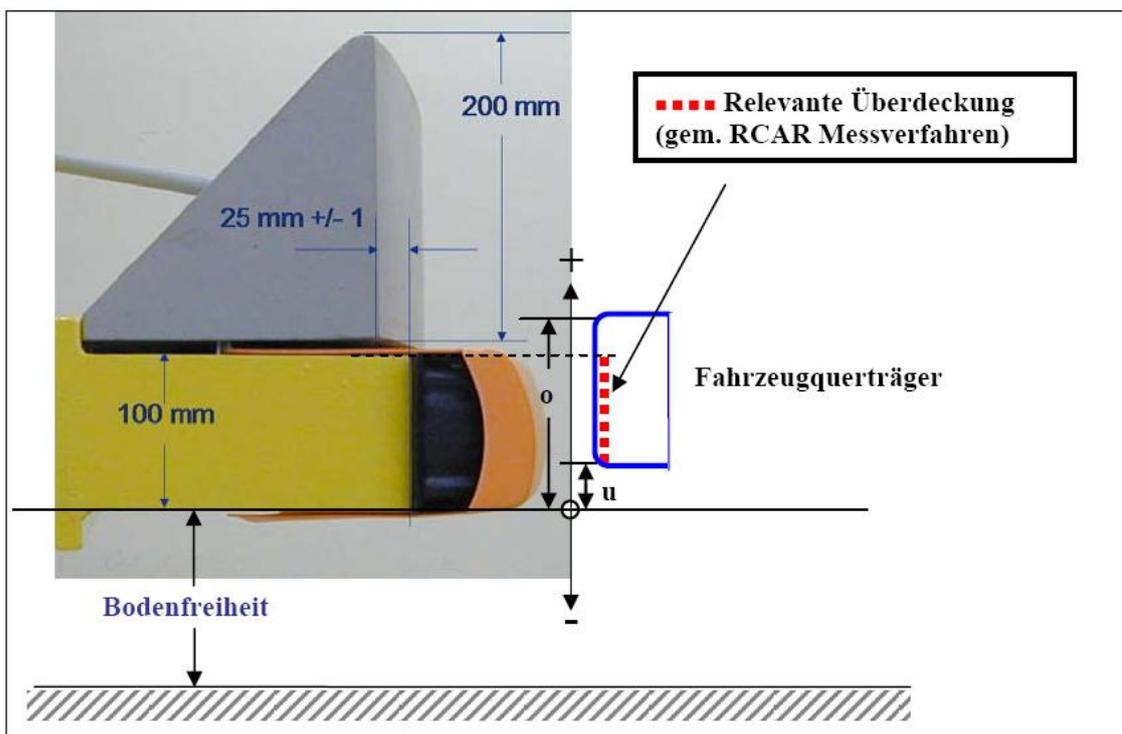
- List of damaged parts
- Front view with & without bumper beam
- Picture of damaged parts
- Picture of cooling package (in case of movement also from back side and from fixing points)
- Pictures of side member flange LH & RH

Bumper beam rear

Drawing or picture of bumper beam:



Bumper beam height measuring point right [mm]:	
Bumper beam height measuring point center [mm]:	
Bumper beam height measuring point left [mm]:	
Qualifying bumper beam height per RCAR [mm]:	
Barrier ground clearance [mm]:	
Position bumper beam to barrier bottom edge (u) Measuring point right / center / left [mm]:	
Position bumper beam to barrier top edge (o) Measuring point right / center / left [mm]:	
Relevant bumper engagement RCAR [mm]:	



Messungen vor und nach Versuchsdurchführung:

- Body gaps rear fender / rear door LH & RH
- Body gaps tailgate / body
- Side member LH & RH at side member flange and min. 2 other Measuring points in x-direction (unstressed condition)

During testing:

- Lineup with & without bumper cover (fascia)



- Video documentation side (y-direction) & top view (z-direction)
Remarks: - Display detail side view: Rear incl. rear wheel
 - Rear wheel mark with white dot on tyre wall
 - Display detail top view: complete vehicle width incl. rear screen bottom edge or roof edge
- Measurement of vehicle deceleration in x- and z-direction at RH or LH side member behind flange to establish path of vehicle structure with 2-time integration
- Judgement of override/underride based on video and path.
Criteria: Vertical movement of test vehicle during rearward motion must be smaller than relevant engagement as per RCAR.

Documentation of damage after impact:

- List of damaged parts
- Rear view with & without bumper beam
- Picture of damaged parts
- Picture of Rear panel
- Picture of tailgate
- Pictures of side member flange LH & RH

Information on the implimentation of RCAR crash standards in the German insurance vehicle rating system and information on AEB systems

Document 5

Statement „Use of the lower load path (lower stiffener – sub frame) for energy absorption in the RCAR 10° structural test”
Issue January 2014, by GDV

Berlin, 10.01.2014

Use of the lower load path (lower stiffener – sub frame) for energy absorption in the RCAR 10° structural test

The use of the lower load path for energy absorption in the RCAR 10° structural test is not suitable to reduce repair expenses in real life accidents. This especially applies when the energy absorption capacity of the main impact rail and bumper system (cross member and crash boxes) is reduced in the same amount. In order to receive realistic crash results, the energy absorption of the lower load path should not exceed 10 to 15 % of the whole energy absorption that is being reached at a RCAR 10° structural test. At the same time it has to be kept in mind that a bigger depth of intrusion as shown in the laboratory does not result in an abrupt rise of repair expenses.

If the lower load path should be necessary primarily because of occupant protection in severe accidents, it should be considered, whether the design could be modified so that the lower load path will be used only when a specific depth of intrusion is reached – which is typically not being reached in small accidents.

Background information:

The RCAR-laboratory tests (structural and bumper test) are simulating the damages to the vehicle that occur in low-speed accidents in road traffic. The basic conditions for these tests were defined in a way that typical real world damages (with respect to cost) are simulated. Vehicle designs, which use the simplified conditions of the laboratory tests (rigid wall) in a way that the absorption of energy is being placed into areas where in real life accidents no counter structure is available, are expected to show considerably higher damages in the field as opposed to the laboratory tests. Thus they are contrary to the actual goal of the insurance ranking methodology. Those kinds of concepts are subject to critical observations by GDV, AZT and the RCAR organization.



In order to fulfill the test criteria for pedestrian protection (lower leg to bumper), almost every manufacturer integrates a so-called lower stiffener as part of the front bumper concept. Assembled in spoiler height, the test dummy equipment receives an additional impulse, which prevents an excessive angle of bending in the knee area. Is the lower stiffener integrated in

the bumper concept exclusively because of this intended purpose, it is usually sufficient to reinforce the bumper plastic cover. The ability to absorb energy with a lower stiffener at a vehicle / vehicle crash is quite small compared to the bumper cross member / longitudinal rails.

However, there are already designs available in the market where the lower stiffener has been developed as a second load path. Within this concept usually a support takes place against the sub frame with defined sections for energy absorption. Due to the simplified conditions in the laboratory test (rigid walls which reach the ground), this concept achieves good results at the RCAR 10° structural tests. On the other hand it has already been proven statistically that an extreme design (with significant impact load) of the lower load path results in a considerably higher cost level in real life accident, with the consequence of rising up in the full comprehensive insurance rating.

This is caused by the fact that in real life accidents energy cannot be absorbed in the area of the spoiler of the bumper cover, because there is no corresponding support on the opponent vehicle of the accident. An experimental investigation by the AZT confirmed these statistical results.

Information on the implimentation of RCAR crash standards in the German insurance vehicle rating system and information on AEB systems

Document 6

Consideration of Driver Assistance Systems "AEB system" at the initial classification procedure

Revision 1
Issue 20 November 2013, by GDV

Consideration of driver assistance systems
“**Automatic Emergency Braking function – AEB system**”
at the initial classification procedure
(status as of 20 November 2013)

Description:

The AEB system duly recognizes a potential collision with an obstacle or other road user travelling in the same direction (parallel traffic), and alerts the driver, if necessary. If the driver does not react, or does not react adequately, automatic emergency braking is initiated, which, depending on the speed difference, avoids a collision completely or reduces the collision speed.

Requirements:

- Standard equipment or 100 % equipment of all vehicles, at least at the manufacturer key number (HSN) / type key number (TSN) level.
- Automatic system activation upon ignition start
- Deactivation option:
 - o The AEB system can be deactivated only by performing at least 3 discrete actions or selection options in the system control or by actuation of a control switch for at least more than 2 seconds (so called long push).
 - o During deactivation the new status of the AEB system is shown to the driver by a visual notification / warning.
 - o Whenever the ignition is started, the AEB system must be active again.
- The AEB system is activated at a speed of $v \leq 10$ km/h and more.
- Reacts to stationary and ahead-driving two-track vehicles in parallel traffic.
- **Complete avoidance of a collision with a stationary vehicle up to a speed difference of at least ≥ 20 km/h,**
- **As of 2016: complete avoidance of a collision with a stationary vehicle up to a speed difference of at least ≥ 30 km/h**
- Documentation and description of the system's efficiency through manufacturer self-assessment

Self-assessment, i. a.:

- Proof of the automatic braking function's efficiency according to RCAR/Euro NCAP test procedures for advanced emergency braking systems.
- What other targets are recognized?
(One-track motor vehicles, bicycles, pedestrians etc.)
- What are the limitations?
(Distance, speed, cross traffic, overlap rate, light and weather conditions etc.)
- If alert function is included:
 - o Time and parameters of the collision alert
 - o Type of collision alert (haptic, visual, acoustic)

- Description of the pre-fill of the brake system, if a potential collision is detected.
- Full description of the deactivation strategy in case of driver reaction.
- What sensors are being used?
(Place of installation, spare part price, replacement time, calibration in case of repair, cost in case of replacement of the windshield, if part of the system is installed at/behind the windshield)
- Existing, system-specific capabilities and efficacy analyses regarding the event of accidents.

Consideration in the classification procedure:

If the above prerequisites and minimum requirements are met, the positive effect to be expected in the event of an accident will be considered as follows:

- **motor liability insurance:** reduction of the initial classification by one type class
- **full comprehensive motor insurance:** reduction of the initial classification by one type class

Consideration of the AEB system will apply throughout the period of validity of the initial classification, and will then be replaced, as hitherto, by statistical data taken from actual claims settlement. When classifying new model series, whose forerunner models had an AEB system that was already considered in the classification procedure, no discount will be granted.