



ANCAP Notes on the Assessment Protocol.

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ANCAP is Australasia's leading independent vehicle safety advocate providing consumers with transparent advice on vehicle safety through its star rating program.



ANCAP

Crash testing for safety

AUSTRALASIAN
NEW CAR ASSESSMENT
PROGRAM

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1 Introduction

The Australasian New Car Assessment Program (ANCAP) conducts crash tests and associated assessments in accordance with the test protocols issued by EuroNCAP (www.euroncap.com).

In 2009 Euro NCAP introduced substantial changes to its rating system. A combined star rating was introduced that covers adult occupants, child occupants, pedestrian protection and safety equipment. However the types of tests conducted and the scoring of injury measurements and modifiers are essentially unchanged. ANCAP is continuing with the adult occupant protection star rating and will continue to obtain and re-publish test results from

Euro NCAP. Therefore ANCAP star ratings will not necessarily match those of Euro NCAP, for the same vehicle model.

This document sets out variations, clarifications and interpretations in the assessment process as determined by the ANCAP Council. Updates are available from www.ancap.com.au

Future changes to ratings policy are set out in a separate document - the ANCAP Ratings Road Map.

References in square brackets to clauses from the Euro NCAP protocol are for version 5.3 of the Euro NCAP Assessment Protocol - Adult Occupant Protection.

2 Star ratings and crash tests

2.1.1 Minimum scores in offset and side impact tests

Version 4.0 of the EuroNCAP Assessment Protocol introduced a minimum score (or "points balance") in each of the offset and side impact tests in order to achieve star ratings. This was suggested by ANCAP to address imbalance between offset and side impact results. The breakpoints are set out in the following table:

Table 1. Breakpoints for star ratings

Star Rating	Minimum score in offset test	Minimum in side impact test	Minimum Combined Score @
5 *	12.5	12.5	32.5
4	8.5	8.5	24.5
3	4.5	4.5	16.5
2	1.5	1.5	8.5
1	-	-	0.5

* To earn 5 stars a vehicle must meet additional requirements, as described in the section "Five Star Qualifiers".

@ Combined score = offset score (max 16) + side impact score (max 16) + pole score (max 2) + seatbelt reminder score (max 3)

In cases where the star rating is limited by an individual score, ANCAP will reduce the overall score to the maximum that is available for that star rating. For example, if a vehicle scored 25.30 overall (including seat belt reminders) but 8.15 in the offset test it would be rated at three stars and its overall score would reduce to 24.49 points (i.e. a truncated score). Similarly a vehicle that had a combined score of 32.5 or more but did not achieve at least one point in the pole test would be rated at four stars and its overall score would reduce to 32.49 points.

Euro NCAP no longer applies the points balance criteria to its new star rating system (Version 5). ANCAP has retained the points balance method due to poor offset crash test performance in some tests.

2.1.2 Qualifiers for a 5-star rating (to 2010)

In order to be awarded a 5 star rating vehicles must meet additional ANCAP requirements, in addition to minimum scores in Table 1:

- a) Effective from 1 January 2003, vehicles must earn at least one point in the pole impact test

- b) Effective from 1 January 2008, vehicles must be equipped with an Electronic Stability Control (ESC) system that meets the requirements set out in Appendix B. The vehicle manufacturer must provide statement of compliance for this purpose.

In the case of a vehicle that lacks ESC but meets the other requirements for 5 stars in Table 1 ANCAP will publish a 4 star rating with an overall score of 32.49. Two ratings (4 and 5 stars) may be published in cases where ESC is optional.

For star ratings from 2011, see Section 3 of this document.

2.1.3 Side impact and pole tests

Exemption from Side Impact Test

ANCAP has a departure from the EuroNCAP testing and assessment protocols for side impact protection for occupants of high-seat vehicles (i.e. with a seat reference height 700mm or more).

The Euro NCAP Mobile Deformable Barrier (MDB) side impact test is the same as the test prescribed in Australian Design Rule 72. ADR72 is not applicable to high-seat vehicles. In 2004 ANCAP identified that there was little value to consumers in continuing to conduct MDB tests on high-seat vehicles in Australia and decided to award all high-seat vehicles a default score of 16 points for this test. However, where available, Euro NCAP side impact test results will continue to be re-published.

Manufacturers are requested to provide advice to ANCAP about seat reference heights to assist with forward planning of test programs. All variants must exceed the 700mm seat height limit for the crash test exemption to apply.

Eligibility for Pole Test

Sep 11 Provided that a head-protection system is fitted [4.1] and four points (pre-modifier) are scored for head protection in the side impact test, then the vehicle will be eligible for a pole test. If, in this test, the following criteria are met, the vehicle will be awarded two additional points (subject to airbag deployment and open door modifiers. See section 2.4).

- HIC36 <1000
- Peak Resultant Acc <80g
- No direct head contact with the pole

Apr 11 From 2008 this optional pole test is only available for vehicles that have achieved at least a 4 star rating (that is, an overall score of at least 24.5 prior to the pole test and at least 8.5 scored in offset and side impact tests). The pole test is conducted by ANCAP, usually at the manufacturer's expense.

Where ANCAP uses crash test data from Euro NCAP the pole test score will only be included in the overall score where the vehicle has achieved at least a 4-star rating without the pole test. A pole test cannot be used to improve a rating from 3 to 4 stars.

Unlike Euro NCAP [4.1], ANCAP does not include other body regions in the scoring for the pole test.

2.1.4 Seat belt reminder

Sep 11 During 2002 Euro NCAP introduced bonus points for seat belt reminders. Under this system, which has been retained by ANCAP, one point is earned each for a driver reminder, a front passenger reminder (or both front passengers, if more than one seat) and a status indicator for all rear seats. The requirements for seat belt reminders are set out in Euro NCAP Assessment Protocol for Safety Assist (copy available from <<http://www.euroncap.com>>).

Manufacturers should be prepared to describe to ANCAP how the operation of the system can be verified by road test, particularly if there are interim warnings.

Prior to 2008 rear seat systems only needed inform the driver about the status of each rear seat belt.

During 2007 Euro NCAP amended the protocol to require the rear seat belt system to give an audible signal if a seat belt is unbuckled while the vehicle is "in use" (eg travelling at more than 25km/h). ANCAP applied this requirement to rear seat belt reminders assessed from January 2008. Rear seat occupant detection is not required to meet this requirement but is recommended.

A single light may be used to indicate both driver and front passenger seat belt status. However, a separate light for each seating position is recommended.

2.2 Frontal offset modifiers

2.2.1 Knee impact modifiers

The Upper Leg Score is subject to modifiers resulting from a post-crash assessment of the knee impact zone [3.2.1.3]. These zones are illustrated in the diagram below and depend on the actual points of impact of each of the dummy knees (driver and front passenger). Where there is no clear evidence of a knee contact (paint marks or deformed components) then that particular zone is not subject to a modifier (but comment may still be made about components that might present an undue hazard to the knees).

A *Variable Contact* modifier (up to 1 point deduction from leg score) applies where the component is clearly stiffer than the structure at the actual impact point and is likely to produce a femur compression in excess of 3.8kN and/or knee slider displacements greater than 6mm. Metal brackets are generally considered to be stiffer than plastic components, unless they are clearly designed to collapse during a knee impact (such as diamond shaped hollow extrusions).

In accordance with Version 4.2+ of the Euro NCAP protocol, the variable contact modifier will be reduced to 0.5 points where there is no concentrated load modifier for that side and the stiffer structure is confined to either the steering column (defined to be 75mm on either side of the centreline of the steering column) or the remainder of the knee impact zone for that side.

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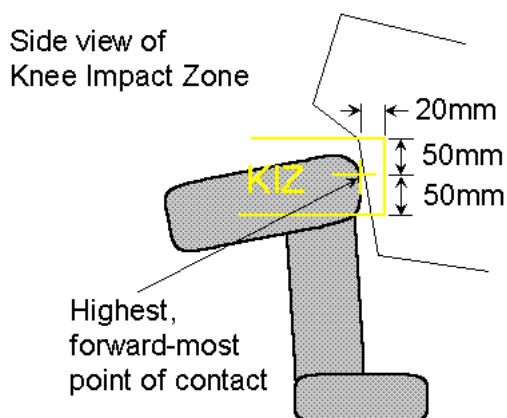
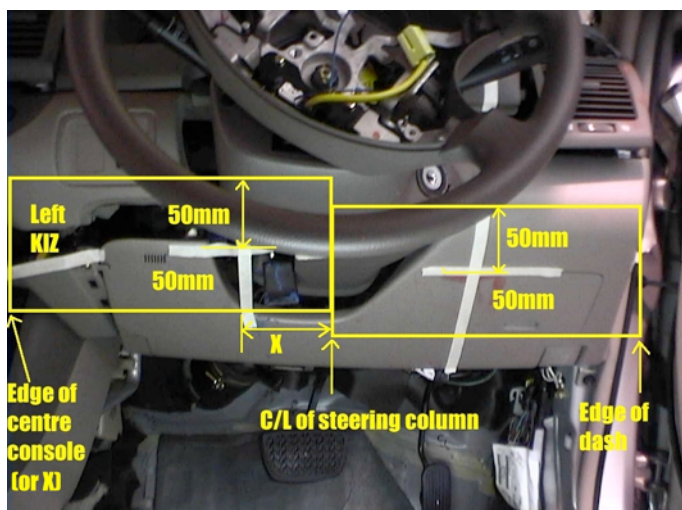


Illustration of Knee Impact Zone (a rectangular prism based on actual points of impact)

Manufacturers may provide test data to show that the injury criteria (femur force and knee displacement) are unlikely to exceed the prescribed limits, if the component of concern is struck by the knee. Euro NCAP has a test procedure "Sled test procedure for assessing knee impact areas" for this purpose and ANCAP accepts Euro NCAP assessments to this

procedure or manufacturer's submissions based on this procedure. However ANCAP also accepts simplified technical evidence, as set out below.

An object is regarded as a “*concentrated load*” if it presents an unyielding impact surface with any linear dimension less than 20mm or otherwise *exposes the knee to a risk of a penetrating knee injury*. For the purpose of this assessment an "unyielding" component is one that deflects less than 10mm when subjected to a load of 400N in the likely direction of a knee impact. A spherical impact surface with a radius of about 25mm would be suitable to simulate knee loading.

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Usually the Concentrated Loading modifier (1 point deduction each knee) applies where the component is also found to be a 'Variable Contact' and the two point modifier is applied. However, cases have occurred where the point of impact was found to be the stiffest structure and high injury measurements were obtained but the component was also found to be a concentrated loading. In this case only the concentrated loading modifier is applied.

Some manufacturers have treated steering column covers and fascia covers with a sandwich of energy absorbing foam and metal sheets which protect the knees from concentrated loads. These have generally been accepted by ANCAP, provided that they protect the knees from hazardous protrusions within the steering column. Results of manufacturer's impact tests that show load distribution and energy absorption would assist in such assessments.

Since the knee assessment depends on the actual points struck by the dummy knees it is possible for the knee impact zone to vary between tests. Several cases have been observed where a component of concern was just outside the knee impact zone but slightly different crash circumstances could have led to a different outcome. Manufacturers should consider such variations when designing steering and fascia components.

2.2.2 Knee airbags

For crash tests conducted by ANCAP no modifiers are applied in cases where a driver knee airbag is fitted, provided that the following requirements are met:

1. The airbag deploys correctly in the offset crash test and the deployed bag would prevent the knees from coming into contact with fascia or steering column components in this type of crash
2. There is no evidence of the airbag bottoming out (eg from femur load trace)

If these requirements are not met then the fascia and steering column will be assessed in the usual way, with an approximation made of the knee contact points from the paint marks on the knee airbag, if there are no signs of contact on these components. In these circumstances the knee airbag housing is likely to be within the knee impact zone.

In cases where Euro NCAP conducted the crash test then the Euro NCAP assessment of the knee airbag is used.

2.2.3 Re-publication of Euro NCAP offset test results - lack of airbags.

Increasingly vehicles tested by Euro NCAP have a driver knee airbag. This usually eliminates knee modifiers. There have been several cases where an Australasian variant of that vehicle model does not have a knee airbag and so ANCAP has either not been able to re-publish the Euro NCAP result or has needed to conduct an offset crash test of the local model without a knee airbag.

The main purpose of the knee modifiers is to take account of situations where the crash conditions are slightly different (such as a different size of occupant). Therefore ANCAP applies full knee modifiers (ie 2 point deduction from upper leg injury score) to the Euro NCAP results where a knee airbag was present in the European test but is not available on the Australasian variant.

Manufacturers have the option of funding an ANCAP offset test, or providing other evidence acceptable to ANCAP, if they consider that the two point deduction is not appropriate for a variant that lacks a knee airbag. .

Where the modifier is applied in this way the ANCAP result sheet will note:

"The vehicle tested by Euro NCAP had a driver knee airbag but the Australasian model does not have this safety feature. ANCAP has applied a 2 point modifier to the driver leg score to take account of the extra risk of injury without the knee airbag".

The same method applies where the model tested by Euro NCAP had a passenger airbag but this is not fitted to an Australasian variant. In this case a 2 point deduction is applied to the front passenger head score for the offset test, unless test evidence, acceptable to ANCAP, is provided by the manufacturer.

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2.2.4 Measurement of intrusion

In accordance with the Euro NCAP, modifiers apply to injury scores for excessive displacement of the steering column, a-pillar and pedals. Under the protocol, displacement is measured relative to a reference point at the rear for the vehicle. The ANCAP assessment varies from this method, as described below.

In tests of utility-style vehicles during 2001 and 2002 it became evident that measurement of intrusion (steering column and pedals) from a reference point on the rear of the vehicle was not appropriate. For the utilities, where there was often substantial crush in the load space. As a result ANCAP reviewed the method of assessing intrusion for all vehicles and decided to utilise a method used by the US Insurance Institute for Highway Safety (IIHS) - assessing intrusion relative to the average of the four mounting bolts of the driver's seat. This method is applied to steering column displacement and pedal displacement (in all three dimensions).

In the case of A-pillar displacement, the approach is similar to that used by IIHS (which assesses door opening width reduction) except that displacement is assessed relative to the C-pillar. This gives an indication of the integrity of the whole passenger compartment. For two-door vehicles the A-pillar displacement is assessed relative to the B-pillar and so is the same as the IIHS method.

This procedure usually results in longitudinal (X) displacements that are less than those assessed according to the EuroNCAP protocol (i.e. in the manufacturer's favour). However, it is possible that vertical (Z) displacements (eg upward movement of steering column) may be greater under the ANCAP system if the driver's seat drops, relative to the original frame of reference. .

Where Euro NCAP results are re-published by ANCAP the Euro NCAP displacement measurements are used because seat mounting point data are not available.

2.2.5 Breakaway brake pedal

Manufacturers should advise prior to the offset test if the brake pedal (and clutch pedal, if applicable) is designed to breakaway in the crash. Successful breakaway avoids a reduced foot score due to rearward displacement of the brake pedal.

2.2.6 Breakaway steering column

Manufacturers should advise prior to the offset test if the steering column is designed to breakaway under load. This will affect the assessment of steering column movement (the modifier is not applied if the post-crash residual displacement cannot be reliably measured AND there is no evidence of excessive steering column movement affecting airbag performance in the crash videos).

2.2.7 Blocked pedal modifier

In 2004 Euro NCAP introduced a blocked pedal modifier for the offset crash test [3.2.1.5].

After the crash the displacement of each pedal is measured with no load and with a forward horizontal load of 200N applied. The second measurement is referred to as a “blocked pedal displacement”. The *unblocked* pedal displacement, compared with the pre-crash pedal position, is used to calculate a foot score, as in the previous assessment protocol (but ANCAP measures both relative to the driver’s seat, as described above (“Measurement of Intrusion”). The second measurement is used to derive a modifier for the foot score. A "blocked pedal" is one that moves forward less than 25mm when the load of 200N is applied. If the *blocked* pedal displacement, compared with the pre-crash position, is less than 50mm then no modifier is applied. If the displacement is more than 175mm then one point is deducted from the foot score. A sliding scale applies between 50mm and 175mm. This is illustrated below.

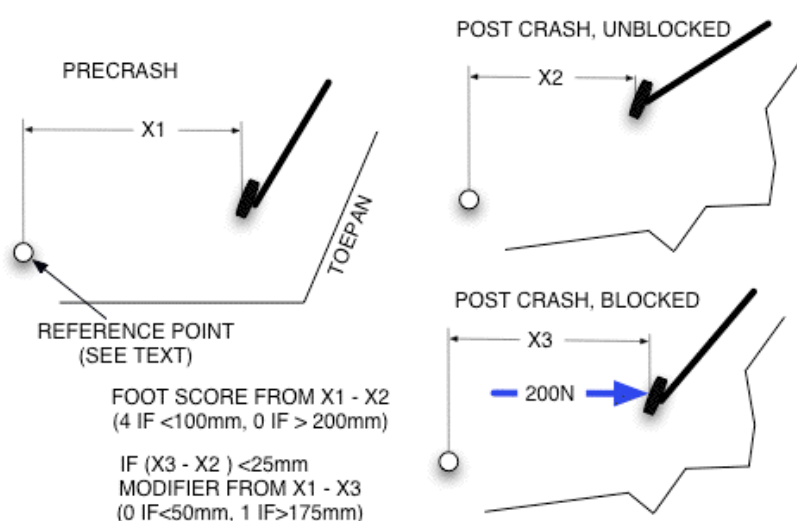


Illustration of blocked pedal modifier

This modifier also applies where the pedal mounts are designed to breakaway during the crash but the pedal still offers some resistance to blocking (successful breakaway earns a pre-modified foot score of 4 points).

ANCAP has applied this requirement to tests conducted from June 2004.

2.2.8 Restraint system integrity (new requirement in 2011)

Where a seat or seat belt component fails or does not operate in its designed manner and this might result in increased risk of injury then a one point penalty is applied to the chest score for that occupant (driver or front passenger). Examples are seat slides releasing, seat mounts detaching, seat belt pretensioners not deploying correctly and seat belt retractors allowing excessive payout of the seat belt.

Where there is obvious direct loading of the chest from the steering wheel, a one point penalty is applied to the driver chest score.’

Note: This **replaces** the "Steering wheel contact" modifier in the Euro NCAP Assessment Protocol [3.2.1.2]. In cases where ANCAP uses a test result from Euro NCAP additional information may be sought from Euro NCAP about restraint system failures and the modifier applied, if appropriate.

2.3 Side impact modifiers

2.3.1 Backplate loads

Backplate loads are measured in side impact tests [4.2.2]. In July 2003 ANCAP began testing to Version 4 of the EuroNCAP test Protocol (including the EuroSID II dummy) and the modifier has been applied to tests conducted from July 2003 .

2.3.2 T12 Modifier

T12 forces and moments are measured and may result in chest modifiers [4.2.3]. This was introduced in Version 4.1 of the Euro NCAP Assessment Protocol and ANCAP has applied the modifier to tests conducted from September 2004 .

2.3.3 Re-publication of Euro NCAP side impact results - lack of airbags

Many vehicles tested by Euro NCAP have side airbags and side curtains. There have been several cases where an Australasian variant does not have these airbags and so ANCAP has either not been able to republish the Euro NCAP result for that variant or has needed to conduct a side impact crash test of the local model without the airbags.

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In 2010 ANCAP began applying a 2 point deduction to the head score where a head-protecting side airbag was present in the European side impact test but was not fitted to the base Australasian variant. Similarly a 2 point deduction is applied to the chest score where a thorax-protecting side airbag was present in the European test but is not fitted to the Australasian variant. The maximum modifier applied to any body region is 2 points.

Manufacturers have the option of funding an ANCAP side impact test, or providing other test evidence acceptable to ANCAP (such as certified ADR72 test results) , if they consider that the local model will score better than when these modifiers are applied to the Euro NCAP result. Where ES2 dummy backplate or T12 data is not available a 2 point deduction is applied.

Where the modifier is applied in this way the ANCAP result sheet have words such as:

"The vehicle tested by Euro NCAP had side airbags/curtains but the Australasian model does not have these safety features. ANCAP has applied a 2 point modifier to the head and chest scores to take account of the extra risk of injury without these airbags."

2.4 General modifiers

2.4.1 Door open modifiers

In accordance with the Euro NCAP Assessment Protocol, one point is deducted for each door that opens during the crash test. This applies to the frontal offset [3.2.3], MDB side impact and pole crash tests [4.2.4]. The points are deducted from the total score for that test. The definition of an "open" door is described in the Euro NCAP protocol [6.3]. It includes cases where a door panel becomes detached, exposing the door trim or occupant to exterior hazards. It also includes gaps between the window frame and the door opening that have potential risk for partial occupant ejection. From April 2011 ANCAP has applied the modifier where such a residual (post-crash) gap is sufficient to allow a hand to pass through (an 80mm diameter sphere can readily pass through the gap). This does not apply where a deployed airbag, such as a side curtain, would likely prevent partial ejection.

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2.4.2 Airbag deployment modifiers

An airbag deployment modifier has always applied to the pole impact test [4.2.1 , 6.2]. From 1 January 2008 ANCAP applied this modifier to the frontal offset and side impact crash tests. These work in the same way as the pole test modifier, where an incorrect deployment results in a one point deduction. The deduction will apply to the head score in the case of the offset

test, to the chest score in the case of a thorax side airbag and to the head score in the case of a head-protecting side airbag. Failed combo airbags (that are intended to provide head and thorax protection) will result in one point deducted from the head score and one point deducted from the chest score.

An airbag is regarded as incorrectly deployed if it does not fully inflate to its design position prior to the occupant loading the airbag. ANCAP only applies this modifier to the test in which the incorrect deployment occurs. For example the incorrect deployment of a side curtain would not be considered if it only occurred during the frontal offset test. This is a departure from the Euro NCAP procedure [3.2.1.1 & 4.2.1].

The Hazardous airbag deployment modifier [3.2.1.1 & Technical Bulletin TB 001], introduced in Version 4.2 of the Euro NCAP protocol, is not currently applied by ANCAP. However, possible hazardous deployments are brought to the attention of the manufacturer.

2.5 Vehicle and dummy set-up

Only ANCAP test contractor staff are permitted to touch or move the dummies during vehicle preparation and after the crash test. If, after installation in the vehicle, the dummy is moved in a way that might cause the neck or spine to be unusually distorted, then the dummy shall be removed, the neck and spine straightened and the dummy reinstalled. Similarly only test contractor staff are permitted to make adjustments to the vehicle. Manufacturers representatives may observe the test set-up and take simple measurements and photographs, provided this does not hinder the set-up process.

Sep 11 Requests by manufacturer's representatives to vary the vehicle settings from that determined by the test contractor must be made prior to 1pm on the day before the test is scheduled to occur. Accommodation of such requests is at the discretion of the test contractor, provided that the set-up is still clearly within the protocol, it does not cause undue disruption to the set-up process and the ANCAP Technical Manager has no objections.

Apr 11 ANCAP does not normally require the test contractor to fit a neck shield to the dummies. These are referred to in the Euro NCAP protocols but are not required for ADR crash tests. Manufacturers may request that a neck shield be used and this will be allowed under the following conditions:

- a) The neck shield is of the soft type that minimises any change to the loading of the neck. FTSS part 1039006 is suitable for this purpose.
- b) The lower edge of the neck shield is tucked inside the dummy flesh in a manner that does not produce any crevices or ridges that might catch the seat belt webbing.
- c) The manufacturer's representative must not touch the seat belt once the dummy has been installed in the vehicle and the seat belt fastened.
- d) The request is made no later than 1pm on the day before the crash test

Sep 11 For the frontal offset test the test protocol (7.5.9.5 of V5.1) states "the seatbelt should lie in a natural position across the dummy sternum and shoulder clavicle. Where this is not the case, for example the belt is close to or in contact with the neck or the belt is **above the shoulder rotation adjustment screw**, and the upper belt anchorage is adjustable the anchorage should be lowered ...". The following picture illustrates the limit based on the shoulder rotation adjustment screw.

Seat belt no higher than adjustment screw



Other set-up items

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- Except where approved by ANCAP, the vehicle's original battery must be the source of electrical power for the vehicle and must be located in its design position.
- Washer bottles shall be filled with water to maximum level.
- ANCAP does not currently require on-board cameras to be used.
- For the offset test the towing points should not be rearward of the front axle. The tow cable will be attached to the lower control arms if there is no other suitable structure.

2.6 Calculation of scores

Measured parameters are rounded to a certain number of decimal places prior to calculation of scores. The number of decimal places used for each parameter are included in the ANCAP assessment report (score sheet). In general injury measurements are rounded to two decimal places but, in the side impact test, abdomen force and pubic symphysis force are rounded to three decimal places (the sliding scale is very sensitive for these injury parameters). Deformation measurements are taken to the nearest millimetre.

Resulting scores are calculated to three decimal places. These are added together to give a test score to three decimal places. The individual test scores are added together to give a combined score and this is rounded to two decimal places.

Bonus points (currently only available for seat belt reminders) are added to the combined score, if applicable.

Star ratings are assigned according to Section 2.1.1 and, from 2011, Section 3.

If the *premodified* injury score for the head, chest, abdomen or pelvis is zero then a warning note (eg "High risk of life threatening chest injury in side impact") is added to the published overall rating. ANCAP assessment reports also use a "struck star" for reference purposes, but this is not included in the final ANCAP publication.

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Dummy injury outcomes are graded from Good to Poor, in accordance with Table 2. Note that prior to 2011 the Marginal rating was split into Marginal and Weak - the same as Euro NCAP.

Table 2. Descriptive ratings for Injury Scores

Body Region Score	Descriptive rating
4	Good
2.67 to 3.99	Acceptable
0.01 to 2.66	Marginal
0	Poor

For any one body region the maximum deduction due to all modifiers applying to that region is two points [3.2.1 & 4.1]. The deduction is truncated to two points if the modifiers add up to more than two.

ANCAP does not apply the "capping limit" provisions that are used by Euro NCAP and result in zero test scores in some circumstances [2.1, 4.1]

2.7 Child restraint assessment

Manufacturers are encouraged to nominate models of child restraint that have been found to suit the vehicle being tested and are available from dealers. Otherwise a default model of child restraint will be used by the test organisation.

Child dummies are instrumented and parameters are recorded but they are not currently assessed by ANCAP. The Euro NCAP protocol for assessing child restraints is not appropriate for the designs of child restraint systems (CRS) used in Australia. For background see the research report "Effectiveness Of Child Restraints, The Australian Experience" available from <http://tinyurl.com/yrorg9>.

Recommendations for assessing the compatibility between child restraints and vehicle are set out in the appendix to that research report. ANCAP has no plans to implement these recommendations in the short term but manufacturers should consider the issue of CRS to vehicle compatibility when designing new vehicles.

2.8 Pedestrian ratings

In association with a major change to the test protocols (a change to impact headforms), ANCAP has replaced a pedestrian star rating with a descriptive rating, as set out in Table 3

Table 3. Descriptive ratings for pedestrian protection for Version 5+

Score	Old star rating	New descriptive rating
27.5 or more	4 stars	Good
18.5 to 27.49	3 stars	Acceptable
9.5 to 18.49	2 stars	Marginal
0.5 to 9.49	1 Star	Poor
Less than 0.5	Zero stars	Poor

In 2009 Euro NCAP ceased publishing a star rating for pedestrian protection and now reports the score, as a percentage.

One requirement of the Euro NCAP Pedestrian Protection Protocol is that head impact points must not be closer than 165mm. Version 5.0 of the protocol removed the spacing requirement for points selected at the base of the windscreen, with the intension of preventing areas encompassing the base of the windscreen from being awarded a score from structure above or below the windscreen base. The wording of the protocol is: "*Where the spacing requirements in Section 4.4.3.4 prevent the worst case location from being tested on the windscreen base area, that quarter will be awarded the score from the most appropriate adjacent or symmetrical quarter.*"

It has been pointed out to ANCAP that this provision makes the scoring highly sensitive to the longitudinal location of the grid lines and does not account for the less injurious clear region of the windscreen that is normally awarded a default "pass". It is possible for the score to change by 5 points (10 grids @ 0.5 points each) through a small change in the location of the gridline (usually the 1800mm wrap-around line). In order to make the scoring less sensitive to the grid lines ANCAP has decided to add the following clause to the pedestrian test set-up:

If a wrap line falls on the windscreen base area such that test locations can be selected on the base of the windscreen in both the zones above and below the wrap line then the zones on the windscreen shall be longitudinally split into two equal sections with each section awarded up to 0.25 points.

The effect of this provision is illustrated in the figure below.

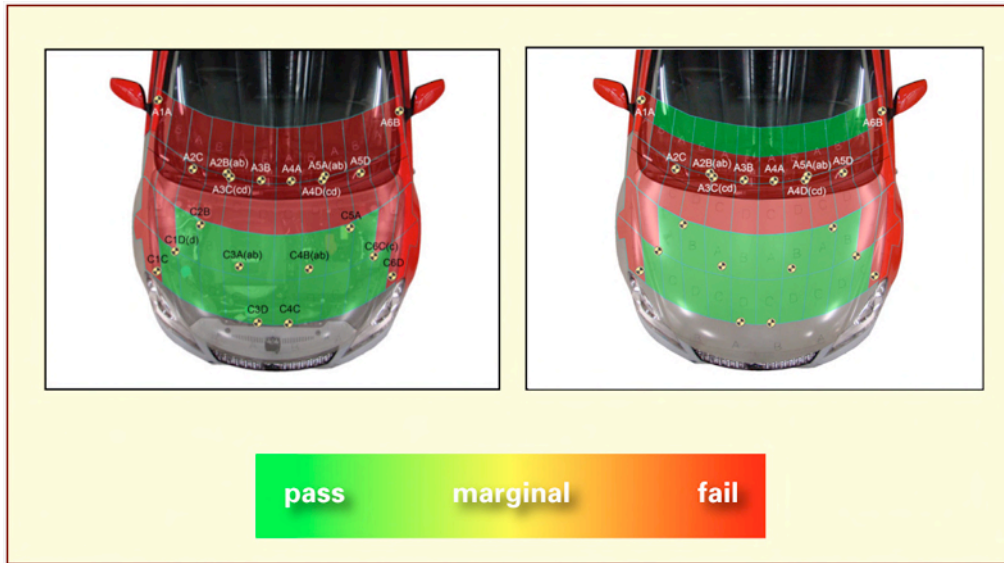


Illustration of revised scoring. Original method on left (zero points for windscreen region) and the revised method on the right (2.5 points for windscreen region).

The test contractor for pedestrian tests is the Centre for Automotive Safety Research (CASR) in Kent Town, South Australia. The pedestrian tests typically takes 4-5 days to complete. The test vehicle is required at least four weeks before the test date to mark the vehicle and give manufacturers an opportunity to nominate additional test areas. This includes an allowance of two weeks for manufacturers to nominate test areas after the first points are selected by CASR. In any case, it is recommended that manufacturers contact CASR about the timing of preparation and tests.

It is best if the spare parts arrive around the same time as the vehicle. Manufacturers are encouraged to contact CASR to determine the likely parts and quantities needed for testing. As a guide, the spare parts typically needed are:

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- 10 bonnets
- 1 set of bonnet rubbers, liner and clips
- 1 bumper fascia
- 2 bumper foams
- 1 set of bumper fascia clips
- 1 set of head lights
- 2 grilles
- 1 full set of wipers
- 2 cowlings (plastic between the bonnet and windscreen)
- 1 windscreen

3 Star Ratings from 2011 (ANCAP Road Map)

Apr 11

From 2011 new requirements for the overall star rating were introduced in the form of the ANCAP Road Map. The first Road Map set out requirements for the period 2011 to 2015. It is intended that the Road Map will be reviewed each year and extended to the next year. A summary of the 2011-2016 Road Map is set out below but *reference should be made to the published Road Map for full details and updates*. The current version of the Roadmap can be downloaded from: <http://www.ancap.com.au/media>

Progressively over the life of the Road Map, ANCAP will be introducing new tests, new calculation methods and new safety assist technology (“SAT”) requirements.

The offset frontal, side impact, side pole and pedestrian tests will be retained. Adding to the physical test regime will be whiplash tests (based on work currently undertaken by NRMA Insurance) and roof crush strength tests (based on work undertaken by IIHS since 2009).

In relation to SAT, both mandatory and additional SAT will be required, with the requirements generally becoming more stringent each year. Contact ANCAP for the procedures to propose that a new SAT be added to the list.

The Road Map came into effect on 18 February 2011 and the requirements for 2011 are applied to vehicles rated after that date. From 2012 onwards, the Road Map requirements for each year will come into force from 1 January of that year. For example, the requirements shown in Table 5 for 2015 are only applicable to new models ***first released to the Australian/New Zealand market in 2015***. If a new model was first released in 2015 but is rated by ANCAP in 2016 then the 2015 criteria will be applied. Similarly, even where a vehicle is crash-tested prior to 2015 (e.g. Euro NCAP test results are available) ANCAP will apply the 2015 requirements, if that model is released in Australia or New Zealand in 2015.

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3.1 Minimum crash test scores

The minimum scores set out in Table 1 are retained. Seat belt reminders will continue to contribute to the combined score that is required in this table. Seat belt reminders will also be assessed as mandatory SAT, as detailed below.

3.2 Pedestrian protection

A minimum rating will be required for pedestrian protection, starting with a minimum Marginal rating to be eligible for an overall 5-star rating in 2012 (or 2014 for "high seat" vehicles).

3.3 Whiplash Protection

A minimum rating will be required for whiplash protection, starting with a minimum Acceptable rating to be eligible for a 5-star rating in 2012. The assessment is conducted in accordance with RCAR-IIWPG Seat/Head Restraint Evaluation Protocol (<http://www.rcar.org/Papers/Papers.htm>). The assessment involves a static geometric assessment and, if the geometric assessment is adequate, a single dynamic test of a representative seat. This differs from the Euro NCAP assessment that uses three dynamic tests. However one of the Euro NCAP dynamic tests matches the RCAR criteria and so data from that Euro NCAP test may be used by ANCAP to derive a whiplash rating according to the RCAR protocol.

Whiplash ratings will continue to be conducted by NRMA Insurance and ANCAP will include these ratings on published datasheets. ANCAP might assist in this process by providing seats from vehicles acquired for crash testing.

3.4 Roof Strength

A minimum rating will be required roof strength, starting with a minimum Marginal rating to be eligible for a 5-star rating in 2014. The roof strength rating is based on the single-sided roof crush test of US FMVSS 216 with a rating in accordance with the protocols of the Insurance Institute for Highway Safety: <http://www.iihs.org/ratings/roof/information.html>

ANCAP will normally acquire vehicles and arrange for roof strength test to be conducted. These might be vehicles that have been subjected to ANCAP pedestrian protection tests or NRMA Insurance low speed front/rear impact tests to assess repair costs. Where possible IIHS ratings for models sold in the USA and Australia will be used, subject to consultation with the local manufacturer/distributor.

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3.5 Safety Assist Technologies (SAT)

Safety Assist Technologies are technologies built into the vehicle that can help avoid a crash, reduce the risk of injury during a crash or improve post-crash survival. A wide range of SAT has been considered by ANCAP. Some have been included as mandatory requirements (Table 4) and others are in a list of "Additional SAT" that can be chosen by manufacturers to reach the minimum number of SAT set out in the Roadmap. Some of the SAT are covered by current or proposed protocols for Advanced NCAP as published by Euro NCAP and, wherever possible, ANCAP intends to use Advanced NCAP definitions and protocols. Other assessment criteria are set out in the Roadmap document and some are still under development.

SAT that are shown as mandatory can be counted as "Additional SAT" prior to them becoming mandatory. For example Emergency Brake Assist becomes mandatory for a 5 star rating from 2013. From 2011 to 2012 this feature can be counted as an Additional SAT but from 2013 it is not counted towards a 5-star assessment.

Table 4 Mandatory SAT (subject to review)

Feature (see Roadmap definitions)	Comment
Electronic Stability Control (ESC)	Required by ANCAP for 5-stars since 2008. To be extended to other star ratings
Seat Belt Reminders (SBR) for fixed seating positions	Common on front seats for 5-star vehicles. Proposed that it remains part of the star rating score, as well as a SAT requirement. To be extended to other star ratings and to rear seats
Head-protecting technology - side airbags (HPT)	Required by ANCAP for front seats for 5-stars since 2004 (pole test). To be extended to other star ratings and to rear seats
Emergency Brake Assist (EBA)	Common on most 5-star vehicles
3-point seat belts for all forward facing seats (3PSB)	Common on most 5-star vehicles

Refer to the Roadmap document for further details, updates and a list of Additional SAT.

Table 5 Summary of Star Rating Requirements under the ANCAP Roadmap (subject to review)

Year	Minimum Frontal Offset Score	Minimum Side Impact Score	Minimum Side Pole Score	Minimum Combined Score ⁴	Minimum Pedestrian Rating	Minimum Whiplash Rating	Minimum Roof Strength Rating	Mandatory SAT ¹	Minimum Additional SAT ²
Requirements for 5 Star Rating									
2011	12.5	12.5	1	32.5	-	-	-	ESC, 3PSB, HPT front seats	-
2012	12.5	12.5	1	32.5	Marginal ³	Acceptable	-	ESC, 3PSB, HPT front seats	2
2013	12.5	12.5	1	32.5	Marginal ³	Acceptable	-	2012 + SBR front seats, EBA	3
2014	12.5	12.5	1	32.5	Acceptable ³	Good	Marginal	2013 + HPT 2nd row seats	4
2015	12.5	12.5	1	32.5	Acceptable	Good	Marginal	2014 + SBR 2nd row fixed seats	5
2016	12.5	12.5	1	32.5	Acceptable ³	Good	Acceptable	"	6
Requirements for 4 Star Rating									
2011	8.5	8.5	-	24.5	-	-	-	-	-
2012	8.5	8.5	-	24.5	-	-	-	ESC	-
2013	8.5	8.5	-	24.5	-	-	-	ESC	1
2014	8.5	8.5	-	24.5	Marginal ³	Acceptable	-	2013 + 3PSB, HPT front seats	2
2015	8.5	8.5	-	24.5	Acceptable ³	Acceptable	-	2014 + SBR front seats, EBA	3
2016	8.5	8.5	-	24.5	Acceptable ³	Good	Marginal	2015 + HPT 2nd row seats	4

Year	Minimum Frontal Offset Score	Minimum Side Impact Score	Minimum Side Pole Score	Minimum Combined Score ⁴	Minimum Pedestrian Rating	Minimum Whiplash Rating	Minimum Roof Strength Rating	Mandatory SAT ¹	Minimum Additional SAT ²
Requirements for 3 Star Rating									
2011	4.5	4.5	-	16.5	-	-	-	-	-
2012	4.5	4.5	-	16.5	-	-	-	-	-
2013	4.5	4.5	-	16.5	-	-	-	ESC	-
2014	4.5	4.5	-	16.5	-	-	-	2013 + 3PSB	1
2015	4.5	4.5	-	16.5	-	-	-	"	2
2016	4.5	4.5	-	16.5	Marginal ³	Acceptable	-	2015 + HPT front seats	3
Requirements for 2 Star Rating									
2011	1.5	1.5	-	8.5	-	-	-	-	-
2012	1.5	1.5	-	8.5	-	-	-	-	-
2013	1.5	1.5	-	8.5	-	-	-	-	-
2014	1.5	1.5	-	8.5	-	-	-	ESC	-
2015	1.5	1.5	-	8.5	-	-	-	"	1
2016	1.5	1.5	-	8.5	-	-	-	2015_ + 3PSB	2
Requirements for 1 Star Rating									
2011	-	-	-	0.5	-	-	-	-	-
2012	-	-	-	0.5	-	-	-	-	-
2013	-	-	-	0.5	-	-	-	-	-
2014	-	-	-	0.5	-	-	-	-	-
2015	-	-	-	0.5	-	-	-	-	-
2016	-	-	-	0.5	-	-	-	ESC	-

See notes (overleaf)

1. Must be standard on the variant being assessed.
 2. For additional SAT to score the full value, the particular SAT must be fitted by the manufacturer as standard equipment. SAT fitted by the manufacturer but specified as optional (extra) equipment only scores half value.
 3. Vehicles with a seating reference height of 700mm or more may meet one grade less for pedestrian protection (eg “poor” instead of “marginal” and “marginal” instead of “acceptable”.)
 4. The Combined Score includes up to 3 points for seat belt reminders (1 for driver, 1 for front passenger and 1 for all 2nd row seats - this is separate from the SAT scoring)
- In the tables - (dash) means 'not applicable' and " (quote) means 'ditto (same as previous year)'

4 Enquiries

Technical enquiries about test and assessment protocols should be addressed to:

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Appendix A - Protocol versions and changes

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Subject to the variations described in the main part of this document, ANCAP conducts tests and assessments to the following protocols:

Euro NCAP

(<http://www.euroncap.com> - technical information - protocols)

- Adult Occupant Protection (AOP) 5.3 June 2011
- Frontal Impact Test Protocol 5.1 February 2010
- Side Barrier Impact Test Protocol 5.1 February 2010
- Side Pole Impact Test Protocol 5.1 February 2010
- Assessment Protocol - Safety Assist 5.4 June 2011 (for seat belt reminders - Euro NCAP Seat Belt Reminder Assessment Protocol Version 1.2 is also acceptable)
- Pedestrian Protocol 5.3 June 2011

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Insurance Institute for Highway Safety

(<http://www.iihs.org/ratings/roof/information.html>)

- Crashworthiness Evaluation Roof Strength Test Protocol Version I, November 2009

Research Council for Automobile Repairs

(<http://www.rcar.org/Papers/Papers.htm>)

- A Procedure for Evaluating Motor Vehicle Head Restraints Static Geometric Criteria Issue 3, March 2008
- RCAR-IIWPG Seat/Head Restraint Evaluation Protocol, Version 3, March 2008

Where more recent protocols are published by these organisations ANCAP may choose to adopt the latest protocols and update this Appendix.

The following table provides a brief historical summary of changes to test and assessment protocols used by ANCAP.

Guide to ANCAP Protocol Changes (subject to review)

Date	OS VER	OS MAX SC	SI VER	SI MAX SC.	POLE VER.	POLE MAX SC	SEAT BELT REMINDER	O'ALL MAX SC.	PED. VER.	PED. MAX.	COMMENT
Nov-99	2.0	16	2.0	16	-	-	-	32	-	-	Euro NCAP protocols introduced. 50km/h SI test introduced. Full frontal dropped.
Nov-00	2.0	16	2.0	16	2.0	2	-	34	2.0	36	Pole & ped tests introduced

Date	OS VER	OS MAX SC	SI VER	SI MAX SC.	POLE VER.	POLE MAX SC	SEAT BELT REMINDER	O'ALL MAX SC.	PED. VER.	PED. MAX.	COMMENT
Nov-01	3.0	16	3.0	16	3.0	2	-	34	3.0	36	Intrusion relative to seat mounts. Breakaway steering column provision (ANCAP only)
Dec-02	3.1	16	3.1	16	3.1	2	-	34	3.1	36	Revised Ped test
Feb-03	3.1	16	3.1	16	3.1	2	3	37	3.1	36	Seat belt reminders
Dec-03	4.0	16	3.1	16	4.0	2	3	37	4.0	36	Points balance for overall score
Jul-04	4.0	16	4.0	16	4.0	2	3	37	4.0	36	ES2 dummy in side impact, backplate modifier
Jan-05	4.1	16	4.1	16	4.1	2	3	37	4.1	36	OS pedal blocking. SI T12 Modifier & barrier revision.
Dec-05	4.1	16	4.1	16	4.1	2	3	37	4.1	36	Points balance limits overall score (clarification)
Jul-06	4.1	16	4.1	16	4.1	2	3	37	4.1	36	Chest modifiers in SI score limited to 2 pt deduction
Oct-07	4.1	16	4.1	16	4.1	2	3	37	4.1	36	ESC for 5 stars, knee modifier clarification, knee airbags, airbag deployment. rear seat belt reminder
Jul-09	4.1	16	4.1	16	4.1	2	3	37	4.1	36	Pole test eligibility clarification. 0.5 deduction for knee modifier. Lack of curtains. ESC minimum speed 20km/h
Jan-10	4.2	16	4.2	16	4.2	2	3	37	5.1	36	Major change to pedestrian protocol. Extra assessment modifiers
Apr-11	4.2	16	4.2	16	4.2	2	3	37	5.2	36	Roadmap introduced. Additional requirements for star ratings. Door gap modifier
Sep-11	5.1	16	5.1	16	5.1	2	3	37	5.3	36	Test protocol update Clarification of ANCAP scoring. Restraint failure modifier (ANCAP)

Appendix B - Electronic Stability Control

For ANCAP rating purposes an Electronic Stability Control (ESC) system is one that:

- a) as a minimum, complies with the following sections of either Global Technical Regulation (GTR) No. 8 (or equivalent sections of ADR31, as amended), or US Federal Motor Vehicle Safety Standard (FMVSS)126 or
- b) is approved by Euro NCAP to "The Dynamic Test of Car Electronic Stability Control Systems Protocol"

Global Technical Regulation (GTR) No. 8

GTR 8 can be downloaded from:

<http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29registry/gtr8.html>

GTR8 Definition & Functional Requirements

"Electronic Stability Control System" or "ESC System" means a system that has all of the following attributes:

- (a) That improves vehicle directional stability by at least having the ability to automatically control individually the braking torques of the left and right wheels on each axle or an axle of each axle group 1/ to induce a correcting yaw moment based on the evaluation of actual vehicle behaviour in comparison with a determination of vehicle behaviour demanded by the driver;
- (b) That is computer-controlled with the computer using a closed-loop algorithm to limit vehicle oversteer and to limit vehicle understeer based on the evaluation of actual vehicle behaviour in comparison with a determination of vehicle behaviour demanded by the driver;
- (c) That has a means to determine directly the value of vehicle's yaw rate and to estimate its side slip or side slip derivative with respect to time;
- (d) That has a means to monitor driver steering inputs; and
- (e) That has an algorithm to determine the need, and a means to modify propulsion torque, as necessary, to assist the driver in maintaining control of the vehicle.

Functional requirements. An electronic stability control system shall be one that:

- (a) Is capable of applying braking torques individually to all four wheels 2/ and has a control algorithm that utilizes this capability;
- (b) Is operational over the full speed range of the vehicle, during all phases of driving including acceleration, coasting, and deceleration (including braking), except:
 - (i) When the driver has disabled ESC,
 - (ii) When the vehicle speed is below 20 km/h,
 - (iii) While the initial start-up self test and plausibility checks are completed, not to exceed 2 minutes when driven under the conditions of [paragraph 7.10.2 ESC Malfunction Detection]
 - (iv) When the vehicle is being driven in reverse;
- (c) Remains capable of activation even if the antilock brake system or traction control system is also activated.

FMVSS 126

A copy of the FMVSS 126 Final Rule can be obtained by going to <http://dms.dot.gov> and searching under docket number 27662.

The reference to 20km/h below is based on the GTR.

a) FMVSS 126 Clauses:

S4. Definitions.

Electronic Stability Control System or ESC System means a system that has all of the following attributes:

- (1) That augments vehicle directional stability by applying and adjusting the vehicle brake torques individually to a vehicle;
- (2) That is computer controlled with the computer using a closed-loop algorithm to limit vehicle oversteer and to limit vehicle understeer;
- (3) That has a means to determine the vehicle's yaw rate and to estimate its side slip or side slip derivative with respect to time;
- (4) That has a means to monitor driver steering inputs;
- (5) That has an algorithm to determine the need, and a means to modify engine torque, as necessary, to assist the driver in maintaining control of the vehicle, and
- (6) That is operational over the full speed range of the vehicle (except at vehicle speeds less than 20 km/h or when being driven in reverse).

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S5.1 Required Equipment.

Vehicles to which this standard applies must be equipped with an electronic stability control system that:

S5.1.1 Is capable of applying brake torques individually to all four wheels and has a control algorithm that utilizes this capability.

S5.1.2 Is operational during all phases of driving including acceleration, coasting, and deceleration (including braking), except when the driver has disabled ESC, the vehicle speed is below 20 km/h, or the vehicle is being driven in reverse.

S5.1.3 Remains capable of activation even if the antilock brake system or traction control system is also activated.

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b) ESC systems that can be switched off are permitted provided that:

(a) a visual indicator is provided which activates whenever the ESC system is switched off and

(b) the ESC system is activated automatically each time the ignition is switched on.

c) Alternative symbols and words to those specified in FMVSS 126 are acceptable for instrumentation displays, provided they are clearly explained in the owner manual.