

## Application of ANCAP star ratings to variants of vehicle models

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### Abstract

The Australasian New Car Assessment Program (ANCAP) crash tests vehicles and assigns an occupant protection rating out of five stars. Most NCAP organisations usually only test and rate one variant of a vehicle model. Other variants may differ from the tested vehicle in a number of ways. These factors include: body style, engine, transmission, mass and mass distribution, safety features and crashworthiness-related structure. They can all be expected to influence the crash test results to some degree. Historically, NCAPs around the world have not made any claims or statements about these untested variants. There is an increasing demand for information about the star rating of non-tested variants of models. One reason is that many vehicle fleets now insist on a minimum 4- or 5-star rating for the new vehicles that they purchase. During 2009 a working group of ANCAP considered ways in which a star rating could be extended from the tested variant to other variants. This paper sets out the results of that review and the policy that has now been published by ANCAP. This policy allows the rating of many more variants and provides benefits for consumers, ANCAP and vehicle manufacturers.

### Keywords

ANCAP, NCAP, crash testing ratings, occupant protection

### Introduction

NCAP organisations usually test and rate one variant of a vehicle model. Other variants may differ from the tested vehicle in a number of ways. These include: body style, engine, transmission (including 4x4 vs 4x2), left- or right-hand drive, mass and mass distribution, and safety features. These can all be expected to influence the crash test results to some degree. Generally NCAPs do not make any claims or statements about non-tested variants.

"Stars on cars" programs, where NCAP ratings are displayed on vehicles in showrooms, can be limited by the lack of published ratings for some variants of a model. Furthermore, increasingly as vehicles achieve top ratings, manufacturers are keen to have these ratings apply to other variants of the model.

To determine the star rating of variants, one option is for manufacturers to sponsor additional NCAP crash tests of these variants. However, to minimise the need to do this with the associated costs, it would be beneficial if there were agreed guidelines to determine the untested model variants that can be rated by ANCAP, based on results from a tested vehicle variant. This document sets out ANCAP policy for these situations.

### Method

The likely influence of key factors is considered in the following table, together with criteria that should be met in order for the variant to receive the same rating as the tested variant. In some cases, the variant might receive a lower score and possibly a lower star rating than the tested variant.

Where any of the criteria in Table 1 are not met, additional evidence is required as set out in the Appendix.

**Table 1.** Criteria for comparable occupant protection

Factor	Criterion
a) Body style (e.g. 3-door hatch, 5-door hatch, sedan, coupe, wagon)	For the purpose of assessment a transverse vertical plane is defined that is 500mm rearward of the upper seat belt anchorage point for the driver seat. Forward of this plane, variants must be identical in design and structure for crashworthiness purposes. A statement from the manufacturer is acceptable for this purpose, subject to visual verification. This includes the front seat belt anchorages but not rear seat belt anchorages. For example, a 3 door hatch result cannot be used for a 5 door hatch variant and vice-versa, without <i>additional evidence for all tests</i> . However, a sedan or wagon variant might be interchangeable with a 5 door hatch.
b) Kerb mass	Variation up to $\pm 10\%$ is allowed.
c) Engine (displacement, cylinder configuration, aspiration, block size, type of fuel)	The same block size & configuration is allowed, irrespective of displacement, aspiration and fuel. Extra components within the engine bay such as LPG convertors and turbo-chargers are acceptable provided that footwell and pedal intrusion are well controlled in the tested vehicle (i.e. 4 points scored for driver's feet - this means that pedal rearward displacement is under 100mm and there is no footwell rupture). Note that a 4 cylinder result cannot be used for a V6 result and a V6 result cannot be used for a V8, and vice versa, without <i>additional evidence for the offset test</i> . Engine differences are acceptable for the side impact and pole tests. For the pedestrian protection rating, components that reduce the bonnet clearance and/or stiffness of a bonnet impact will be assessed. Extra head impact tests might be undertaken at ANCAP's discretion.
d) Transmission (manual or auto, number of gears)	Any transmission is acceptable. Note that ANCAP policy for selection of test vehicles is that an automatic transmission will only be selected if at least 80% of that variant sales are automatic.
e) Driven wheels (4x4, 4x2, front-wheel drive, rear wheel drive)	Two wheel drive results (either front or rear) are not interchangeable with an all-wheel-drive variant without <i>additional evidence (offset test)</i> due to the effect of the rear driveline. Similarly front-wheel drive results are not interchangeable with rear-wheel-drive results, without <i>additional evidence</i> . Driven wheel differences are acceptable for the side impact and pole tests.
f) Ride height (eg height of top of wheel arch) and tyre diameter	<i>Offset test</i> acceptable provided that the ride height does not vary by more than $\pm 50$ mm from the tested variant. <i>Side impact test</i> of lowest variant may be used for other variants up to the point where the default score is used for a high-seat vehicle*.
g) Wheelbase	Wheelbase variation up to $\pm 100$ mm is acceptable.
h) Driver location (left-hand-drive, right-hand drive)	Where ANCAP has published a rating based on crash tests of a left-hand-drive (LHD) variant, that rating may be applied to other variants in Australasia subject to meeting the relevant criteria in this table.
i) Front occupant restraint systems	Subject to items j to m, installed airbags must be the same as the tested variant, or better. For example, for the purpose of the side impact test, curtains may be fitted where the tested variant had seat-mounted side airbags with head protection. However, <i>additional evidence</i> is required for the pole test, where the type of head-protecting side airbag is different. Front seat belt pretensioners and load limiters must be identical. Front seat belt anchorages must be identical in geometry and adjustment features. Seat design must have similar restraint-related features, such as anti-submarining pans. Upholstery and adjustment features may vary.

j) Lack of passenger front airbag	<i>Offset test</i> results for a variant with a front passenger airbag may be used for a variant without a front passenger airbag but a score deduction normally applies. Where a Euro NCAP tested variant had a front passenger airbag and the variant being assessed does not have this then a 2-point deduction is applied to the front passenger head score ( <i>offset test</i> ), unless <i>additional evidence</i> is provided (new policy).
k) Lack of head-protecting side airbag (not high seat vehicle*)	Where a tested variant had a head-protecting side airbag and the variant being assessed does not have this then a 2-point deduction is applied to the head score ( <i>side impact test</i> ), unless <i>additional evidence</i> is provided (new policy). Test data from an acceptable Australian Design Rule (ADR) 72 crash test would be suitable for this purpose.
l) Lack of thorax-protecting side airbag (not high seat vehicle*)	Where a tested variant had a thorax-protecting side airbag and the variant being assessed does not have this then a 2-point deduction is applied to the chest score ( <i>side impact test</i> ), unless <i>additional evidence</i> is provided (new policy). Acceptable ADR72 test data would be suitable for this purpose but 2-point deduction applies where these data do not include dummy backplate or T12 measurements.
m) Lack of knee airbag	Where a tested variant had a knee airbag and the variant being assessed does not have this feature available then a 2 point deduction is applied to the driver/passenger upper leg score ( <i>offset test</i> ) unless <i>additional evidence</i> is provided (existing ANCAP policy).
n) Other safety features	Intelligent seat belt reminders are assessed and scored for each variant. Therefore variants with different numbers of seat belt reminders will have different scores. ESC is required for a 5 star rating. Variants that miss out on 5-star due to a lack of ESC can only obtain a maximum 4-star rating (overall score 32.49 points). Similar arrangements will apply if ANCAP introduces additional qualifiers for a star rating. In the case of station wagons and vans that are car derivatives, a 5-star rating will only be available where that variant has a cargo barrier (standard or optional equipment) that complies with AS 3034 (or acceptable equivalent).

\* "High seat vehicle" is a vehicle with a seating reference height more than 700mm which is therefore exempt from the ADR72 side impact test. ANCAP applies a default 16 points for these vehicles, unless a EuroNCAP test result is available that is less than 16 points.

## Conclusions

Extending the ANCAP rating of a vehicle model to a range of variants through the examination of data has several positive outcomes. It provides more information for consumers when they wish to purchase a vehicle, it extends ANCAP's range of results at minimal cost and it provides a route for manufacturers to have more of their vehicles rated at comparatively low cost.

## **APPENDIX**

### **Additional evidence to be provided by the vehicle manufacturer**

The manufacturer's submission should address each of the technical items set out in Table 1, indicating whether the criteria are met.

Where a manufacturer seeks to apply an ANCAP rating to a variant that does not meet the criteria set out in Table 1, further engineering evidence is required to show that the additional variant provides at least the same level of occupant protection as the tested variant for the type of crash test under consideration.

Additional evidence may also be submitted where ANCAP proposed to use default deductions due to a lack of side airbags (j, k, l & m in Table 1).

Manufacturers may also submit evidence to show that an ANCAP rating should not be applied to a particular variant, despite it meeting the criteria of Table 1.

Submissions from manufacturers will be circulated within the ANCAP Technical Working Group on a confidential basis.

### **Crash performance comparisons**

The main purpose of the test data is to show comparable performance so that the existing ANCAP test results can be applied to the additional variant or to show that the additional variant performs better than that derived from a default score (e.g. where ANCAP proposes to apply a 2-point deduction due to the absence of airbags). Manufacturer's test data is not acceptable for deriving a *higher* star rating for an additional variant - only ANCAP or other acceptable NCAP test data may be used for this purpose.

Acceptable engineering comparisons include:

- a) Crash tests for related regulation compliance tests, at regulation speeds or higher (such as ADR72 and ADR73)
- b) Crash tests at NCAP speeds conducted according to ANCAP/Euro NCAP protocols by or on behalf of the manufacturer at an approved test facility (e.g. acceptable for ADR certification purposes)
- c) A Federal Motor Vehicle Safety Standard (FMVSS) 214 Oblique Pole Test may be used to demonstrate the effectiveness of a head-protecting side airbag/curtain, as an alternative to a Euro NCAP-style pole test.
- d) Results of computer modelling should show comparable structural deformation (including footwell and firewall) and vehicle body deceleration. Mathematical Dynamic Models (MADYMO) modelling, or equivalent, of dummy responses is preferred.

The tested models should be built to Australian specifications, but overseas specifications (e.g. comparisons between two LHD variants) may be acceptable.

Manufacturers' representatives are encouraged to contact the ANCAP Technical Manager to discuss the types of evidence that are proposed to be submitted. In general only summary test data, that identifies the vehicle, the type of test, the test facility and the key injury measurements, is required by ANCAP.

### **Crash test comparisons**

Where crash tests are compared the injury values for the additional variant should not exceed 110% of those in the ANCAP-tested variant unless:

- a) the resulting injury scores are in the good range (i.e. score 4 points under the ANCAP assessment protocol) or

- b) the resulting crash test and overall scores for the variant are sufficient to retain the same star rating as the tested variant