

## INTERNATIONAL NCAP PROGRAMS IN REVIEW

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### ABSTRACT

This paper summarises recent international NCAP programs and results. New Car Assessment Programs (NCAPs) are now running on four continents - Australia, United States, Japan and Europe. All use one or both of the standardised 56 km/h full frontal and the 64 km/h offset with deformable barrier tests.

Australian NCAP (ANCAP) commenced in 1992 and has now tested over 60 models. ANCAP has recognised the global nature of the car manufacturing industry and has developed the testing program to align with existing consumer crash testing programs operating overseas and to suit the types of crashes resulting in fatalities and serious injuries in Australia.

ANCAP will continue to push the bounds of technology to achieve improvements in occupant protection of passenger cars. ANCAP was the first consumer crash testing program that combined both full frontal and offset crash tests to produce a more accurate and meaningful result. The marked improvements in protection for occupants in passenger cars that are involved in frontal collisions in Australia shows that ANCAP has been very successful.

In the last few years NCAP programs have started in Europe and Japan and both include pedestrian impact tests that are not yet conducted in Australia. Side impact crash standards have been introduced in the US, Europe and in Australia. Pedestrian impact standards are under development in a number of countries. ANCAP intends to introduce a side impact test program in the near future.

Other NCAPs are also looking at enhancements to programs and possible future directions. For instance, research has begun in the US on a dynamic test that will provide a reliable measure of a vehicle's rollover susceptibility.

### 1 INTRODUCTION

#### 1.1 Overview of Vehicle Safety in Australia

Australian vehicle safety standards consist of design rules for individual items and until recently did not provide for a test of the total occupant protection system.

A barrier test based on the 1987 US Federal Motor Vehicle Safety Standard (FMVSS) 208 was introduced from July 1995 and is known as Australian Design Rule (ADR) 69. This test has an impact speed of 48 km/h and the results are not made public.

Research by the Federal Office of Road Safety (FORS) and the Monash University Accident Research Centre (MUARC) shows that frontal crashes make up approximately 60 percent of the total serious and fatal injury crashes in Australia. Of all frontal crashes around half are offset.

Some of the Australian New Car Assessment Program (ANCAP) partners have funded MUARC to research real world accidents. MUARC has developed a vehicle crashworthiness rating system based on a method used by the Folksam Insurance company in Sweden. The method uses police crash reports from on-road crashes and registration databases from road authorities in NSW and Victoria.

The matching of the files is based on the registration number. The injuries received in each crash are matched with the vehicle model. The size of the database, greater than 350,000 crashes in the last analysis, provides statistical rigour to the results (MUARC 1998). The RACV, NRMA and NSW RTA publish this safety information as a guide for consumers considering the purchase of a used car.

MUARC has also been funded to evaluate the correlation between the ANCAP results and real world crash data. This research has been published in 1996 and 1997 and shows a good correlation between ANCAP scores and on-road occupant protection.

## 1.2 Australian New Car Assessment Program (ANCAP)

ANCAP was introduced to provide new car buyers with useful information about the relative occupant protection of popular vehicles on the Australian market. This information influences consumer demand and encourages manufacturers to design safer vehicles.

ANCAP commenced in 1992 using the US NCAP full frontal test. The first tests involved nine medium/large family vehicles and results were published in April 1993. From 1994 an offset test based on a draft European standard was also incorporated.

ANCAP is funded by Australian motoring clubs through the national Australian Automobile Association (AAA) and transport authorities in Queensland, New South Wales and South Australia. The program has a budget of A\$1 million per year.

ANCAP has a management committee which is chaired by the AAA. The program is operated by a Technical Committee made up of stakeholder representatives who meet regularly. The testing is conducted by a contractor called Crashlab, located in Sydney, New South Wales.

ANCAP has released 13 sets of results so far, covering small, medium and large cars as well as light commercial vehicles, four wheel drives and passenger vans. Selection of vehicles for testing is based on sales volume. There are current results for over 30 of the most popular new vehicles presently on sale in Australia covering around 75% of the new vehicle market.

### 1.3 Testing

ANCAP has recognised the global nature of the car manufacturing industry and developed a crash testing program to align with existing overseas programs.

In addition to the full frontal test, an offset test using a deformable barrier was added in 1994. This test was developed for the European Experimental Vehicle Committee (EEVC) by the Transport Research Laboratory (TRL) in the UK. The test is recognised internationally and the barrier design is specified for both consumer crash test programs and for compliance with regulatory standards.

Each vehicle model tested in ANCAP undergoes a full frontal crash test into a solid concrete barrier and an offset crash test into a barrier with a deformable aluminium face.

The full frontal crash test simulates hitting a solid object or another vehicle exactly head-on and is conducted at a speed of 56 km/h. In this test the impact is spread evenly across the front of the vehicle. This test mainly evaluates the vehicle's restraint system.

The offset crash test simulates hitting another car and is conducted at a speed of 64 km/h. Forty percent of the width of the car makes contact with the barrier. In this test the crash forces are concentrated on the driver's side of the vehicle. This test mainly evaluates the vehicle structure's resistance to intrusion.

### 1.4 Results Presentation

The presentation of results has evolved by a process of continuous review including focus group evaluations. The current format is based on the US Insurance Institute for Highway Safety (IIHS) brochure and uses ratings of *Good*, *Acceptable*, *Marginal* and *Poor*.

This format was considered to be the best available by the organisations visited during an international ANCAP study tour. Market research in Australia has also shown that consumers find this presentation format relatively easy to understand.

Four areas of vehicle crashworthiness are evaluated - structure, restraints, injury measurements and head restraint design. These are combined into an overall evaluation which is based on both the full frontal and offset crash test results. The results are available on the internet ([www.nrma.com.au/crashtests/](http://www.nrma.com.au/crashtests/)).

### 1.5 Data Sharing

ANCAP is part of a global NCAP network. NCAP organisations are standardising on testing and are sharing results for similar vehicles in different markets. ANCAP, by agreement with the manufacturers, has used IIHS and NHTSA results for the Volvo 850 and Toyota Camry and a Euro NCAP result for the Volkswagon Polo. Japan NCAP is also republishing results from the US program.

The ANCAP ratings based on data provided by overseas organisations might differ from the ratings assigned by these organisations. In particular the ANCAP rating includes assessment of the results of full-frontal crash tests and takes into account the passenger injury measures and restraint performance in these tests. The ANCAP ratings also tend to place less emphasis on footwell intrusion and lower leg injury than IIHS ratings and more emphasis on structural performance than the Euro NCAP procedures.

Of 63 vehicles tested by IIHS or Euro NCAP and provisionally rerated under ANCAP procedures, 35 had the same rating, 18 had a better rating (mainly due to less emphasis on lower leg factors) and 10 had a worse rating (mainly due to the inclusion of the full-frontal test results).

Although it is desirable that the same rating system be used by all organisations this would have several disadvantages for the Australian new car fleet. All vehicles tested by IIHS and Euro NCAP had driver airbags and most (78 percent) had passenger airbags. In Australia less than half of the models tested in recent years have driver airbags and only one had a passenger airbag. The NCAP full frontal crash test is more likely to have an influence on the overall rating for vehicles which have no airbag.

Once the Australian new car fleet aligns more with the US and Europe in regard to airbag fitment and structural performance then harmonisation of the rating procedures will become more meaningful.

Data sharing means that duplication of effort and considerable costs can be avoided and more vehicles can be evaluated. Consumers will then be able to make a more informed choice at vehicle purchase on the basis of occupant protection performance.

## 1.6 Relationships

ANCAP consults with the automotive industry about the program through the Federal Chamber of Automotive Industries (FCAI), the group which represents the vehicle manufacturers and importers in Australia. Representatives from the vehicle manufacturing companies are invited to attend the test of their products and are able to review the results before publication. ANCAP meets with the FCAI before each public launch and in early 1997 conducted a technical briefing for FCAI members on the new IIHS-style rating system.

ANCAP is also working closely with the Federal Government through the Department of Transport's Federal Office of Road Safety (FORS) which administers the design standards for Australian vehicles. In 1996 the then Minister for Transport approved A\$350,000 for a complementary FORS NCAP program to study airbag effectiveness on vehicles being tested by ANCAP. The Government has shown interest in continuing this level of support.

ANCAP has spent substantial time and effort briefing motoring journalists about the program to encourage a consumer perspective in the reporting of vehicle safety issues.

ANCAP has also made many presentations to fleet management groups on the implications of crash test results on vehicle selection for fleet managers.

## 1.7 Market Effect

In 1996 a benefit/cost analysis of NCAP was undertaken. Road trauma costs from the states of Queensland, New South Wales, Victoria and South Australia were used in the analysis. The potential benefit was defined as the likely savings in the social cost of passenger vehicle occupant trauma in full frontal and offset crashes in speed zones of 80 km/h or less. The estimate was therefore conservative as some benefit could also be expected in over 80 km/h speed zones.

The saving was calculated for each future year by multiplying the trauma costs by the injury risks of the improved Australian fleet for the year in question and dividing by the injury risk of the existing Australian fleet.

The costs associated with improving the ANCAP performance of the Australian fleet to the achieved USA level were determined by adding the total cost of the NCAP program to the cost of improving the level of safety of the vehicles.

The analysis was conducted using an estimated cost per vehicle of \$200. After one year a benefit cost ratio of 2.48 is achieved. The benefit cost ratio continues to improve and after 15 years reaches a value of 3.61.

A sensitivity analysis was conducted on the average cost per vehicle to implement US protection standards. This showed that even with conservative assumptions and a 35 year fleet improvement time span, manufacturers can spend up to \$750 per vehicle and still produce a positive benefit to the community.

A visible impact of the program is the amount of safety advertising used by manufacturers, often featuring a crash test dummy. There has also been a significant increase in the number of advertisements featuring airbags and structural details of vehicles.

Due to ANCAP and the consequent increase in safety advertising, Australian car buyers now rate safety as their third most important criterion after purchase and running costs. (ANOP 1997).

The proportion of the new car fleet fitted with at least a driver airbag has risen from 30 percent to 50 percent over four years. This shows the value of a consumer-orientated vehicle safety program and a strategy of promoting the results to influential groups such as vehicle fleet managers.

### 1.8 Future Directions

ANCAP is currently considering other possible programs, including side impact testing which Euro NCAP and US NCAP have already commenced. Euro NCAP is also carrying out pedestrian impact testing on vehicles while the US NCAP has recently announced a program to rate vehicle rollover susceptibility.

ANCAP will continue to network with other global programs and introduce new tests and improvements to results presentation according to international best practice where there is a benefit to consumers.

## 2 ANCAP STUDY TOUR

### 2.1 ESV Conference

The Enhanced Safety of Vehicles (ESV) Conference held in Melbourne during May 1996 had the theme of globalisation and harmonisation of vehicle safety standards. The discussion on international harmonisation of vehicle standards also included consumer crash testing programs, which in recent years have promoted improved occupant protection faster than regulations.

The ESV Conference demonstrated that much activity was occurring on a global scale with consumer crash test programs but there was a need to harmonise test protocols.

### 2.2 Study Tour

ANCAP saw benefits in reducing costs and enhancing the range of results provided by a more co-operative approach between global consumer crash test programs. An ANCAP sponsored overseas study tour was undertaken to follow up the potential benefits of data sharing.

The ESV Conference identified recent NCAP activity in Japan, Europe, United Kingdom and the United States. ANCAP independently discovered that South Korea is developing an NCAP. Visits to various vehicle manufacturers were also arranged in South Korea, Germany, Sweden and the United States.

## 3 UNITED STATES

### 3.1 National Highway Traffic Safety Administration (NHTSA)

NHTSA is part of the US Department of Transportation and has been conducting NCAP testing using the full frontal test at 56 km/h since 1978. About 35 new models are crash tested each year. NHTSA employs four contractors across the US to conduct its NCAP testing.

NHTSA uses a star system to provide consumers with vehicle safety performance information. The results are reported in a range of one to five stars. Five stars indicate the best protection within the same weight class. HIC scores are also reported.

The budget for 1997 was US \$3.2 million which allowed 42 full frontal, 26 side impact and nine offset frontal tests. NHTSA estimated that this program provides safety information for consumers on almost 90% of the vehicles sold in the US during 1997.

The current US side impact standard FMVSS 214 applies to 1997 model year cars and for light trucks in 1998. Similarly to the full frontal program, NHTSA has added 5 mph to the regulatory impact speed, so the NCAP side impact test is run at 38.5 mph (62km/h). NHTSA released several sets of side impact test results during 1997. All US NCAP results are available on the internet ([www.nhtsa.dot.gov](http://www.nhtsa.dot.gov)).

NHTSA has agreed to supply ANCAP with US crash test information.

### 3.2 Insurance Institute for Highway Safety (IIHS)

The IIHS conducts the EEVC deformable barrier offset test with an impact speed of 64 km/h. This test is the same as that used by ANCAP and Euro NCAP. All IIHS tests are conducted at their vehicle research centre in Charlottesville, Virginia.

The IIHS vehicle crash test evaluation procedure uses a four level rating system (*Good, Acceptable, Marginal* and *Poor*). In addition to structure, restraints and injury measures, head restraints and bumper performance are also evaluated and reported. The IIHS provides an overall evaluation on vehicle safety performance but does not use a star rating system.

The IIHS crash test brochure is distributed to a mailing list of 16,000. The results are promoted using both a media release and video news release. Wide television coverage is achieved by an exclusive release on a 30 minute segment on the Dateline program, which has 24 million viewers.

IIHS commenced crash testing in 1994 and has since tested small and mid-size cars, utilities, passenger vans and luxury vehicles. The results are available on the internet ([www.hwysafety.org](http://www.hwysafety.org)).

IIHS has agreed to exchange crash test information with ANCAP.

## **4 JAPAN**

### **4.1 Overview**

The National Organisation for Automotive Safety and Victims' Aid (OSA) was established by the Japanese Government in 1973. OSA is funded yearly by the Ministry of Transport but is a separate legal entity. The primary objectives of OSA are to reduce road trauma through research and to offer assistance to 'victims' of vehicle accidents.

An increase in the road accident fatality rate in 1988 resulted in the Japan NCAP being established in 1991. After five years development the first results were published in March 1996. A second set of results were released in March 1997 and results from a third test program will be published in early 1998.

The "Automotive Safety Information" publication is distributed by both the OSA and the Ministry of Transport. The Japan Automobile Federation (JAF) publishes the results in its magazine JAF-MATE, which has a circulation of 12 million. The results are also promoted on television and are available on the internet ([www.osa.go.jp](http://www.osa.go.jp)).

OSA acknowledges that consumer tests are driving the vehicle safety agenda and international harmonisation of tests is important.

### **4.2 Test Programs**

OSA has a Car Safety Assessment Committee with members from the Japan Automobile Research Institute (JARI) and Japan Automobile Manufacturers Association (JAMA). It also has regular discussions with JAMA members on NCAP related issues.

OSA conducts its full frontal crash test program at JARI. The test is the same as for US NCAP. The numerical test results are not published as OSA believes they are of little interest to consumers. A four category rating system (A/B/C/D) based on head injury criterion and chest acceleration is used. Recently the A category was split into A, AA and AAA levels to further discriminate vehicle safety performance.

The 1996 program tested the top selling nine vehicles across all classes and results were published early in 1997. A total of 18 models have now been reported on. OSA has tested 13 more passenger vehicles during 1997. Results were published in April 1998. The list of models is available on the OSA internet site ([www.osa.go.jp](http://www.osa.go.jp)).

OSA believes its options to provide more vehicle safety data to consumers include:-

- conduct more tests (subject to budget constraints);
- provide overseas NCAP data on vehicles which are sold in Japan; and/or
- provide vehicle manufacturer test data.

OSA is reproducing US NCAP data on similar vehicles sold in Japan. OSA believes that left hand drive data can be used for right hand drive vehicles if the vehicle manufacturer agrees the vehicles are similar.

Japan will have a national regulation for side impact this year. This will be based on the European test. OSA is interested in conducting a side impact test and is reviewing the UK DoT test. OSA is likely to increase the test speed over the regulatory speed by about 10 percent which is intended to show crash performance differences between vehicles. OSA expects to take up to three years to develop this test, which will be discussed through the Car Safety Assessment Committee.

OSA has agreed to exchange crash test information with ANCAP.

## **5 EUROPE**

### **5.1 Overview**

Euro NCAP is funded by the UK DoT, the Swedish National Road Administration, the FIA, the AA UK and the RAC. The Dutch government and the German motoring club, ADAC, have also recently joined the program.

TRL has been the only test contractor for the Euro NCAP up to the current program, when TNO Holland also became a contractor. The objective of Euro NCAP is to provide consumer information. EEVC test procedures for offset frontal impact (64 kmh, 40% overlap, deformable barrier), side impact and pedestrian impact are used

Two vehicles are required for each model tested. One is used for the pedestrian tests then the side impact test. The other is used for the offset frontal test.

## 5.2 Test Programs

The results from the small car program involving seven popular vehicles were released in February 1997 and those from the second program of 13 family cars were launched in July 1997.

## 6 COMPARISON OF GLOBAL NCAPs

### 6.1 Test Harmonisation

During the 1996 Enhanced Safety of Vehicles (ESV) Conference an invited speakers panel provided an opportunity for both industry and government representatives to put forward their view on the future direction of vehicle safety. Speakers representing the Association of International Automobile Manufacturers and the American Automobile Manufacturers Association indicated the need for global harmonisation of safety standards and tests.

The selection of types of tests to be conducted by ANCAP was determined by consideration of the types of crashes resulting in fatalities and serious injuries due to the nature of the Australian road and traffic environment.

Offset barrier testing as carried out by ANCAP is also conducted by the Insurance Institute for Highway Safety and NHTSA in the US, the Transport Research Laboratory in the UK and TNO in Holland. Many car manufacturers also perform offset crash tests but do not release the results. Volvo has conducted 65 km/h crash tests for over 10 years.

### 6.2 Evaluation/Presentation

In ANCAP, four areas of vehicle crashworthiness are evaluated - structure, restraints, injury measurements and head restraint design. These areas are also evaluated in other NCAPs but with slightly different emphasis, partly due to the use by other groups of only one test, whereas Australia carries out two tests on each model.

ANCAP and IIHS have adopted a typical consumer rating system of *Good*, *Acceptable*, *Marginal* and *Poor* which NHTSA and Euro NCAP use a star system, five for NHTSA and four for Euro NCAP. Euro NCAP has combined offset frontal, side and pedestrian testing into one rating.

### 6.3 Information Exchange

There is agreement between all NCAPs that data is freely available to other groups once it has been quality checked and, in some cases, once a media launch has occurred.

ANCAP liaises with the Australian vehicle manufacturing or importing companies to determine the applicability of data from other NCAPs. Manufacturers have also been invited on many occasions to produce their own crash data for comparison but have so far declined to do so.

### 6.4 Future Directions

Generally NCAPs would like to be able to give as complete a guide as possible to consumers when buying a vehicle. Test types and protocols will be introduced and developed to achieve this aim. This would lead to a full evaluation using frontal, side, rear, rollover and pedestrian impacts.

## 7 SUMMARY

The main points relating to global NCAPs and harmonisation of consumer vehicle safety programs are:-

- Japan has established an NCAP based on the US program and is now planning side impact. An NCAP is being considered in South Korea. The Euro NCAP commenced in 1997 and involves frontal, side and pedestrian tests. The US NCAP was expanded in 1997 to include side impact.
- There is almost complete harmonisation between NCAP groups on test procedures except for the German Automobile Club ADAC and motoring magazine *Auto Motor und Sport*. There are some minor differences between NCAP groups in how results of vehicle safety performance are presented.
- There is now an agreement between Australia and other global NCAP groups to share data where vehicle and test specifications are compatible. There is also potential to further share data with the vehicle industry.
- Many manufacturers, including BMW, Mercedes-Benz and Volvo, have emphasised that vehicle safety is more than just dummy measurements and should include assessment of intrusion, head restraint design etc. ANCAP agrees and has developed criteria to provide a more comprehensive overall assessment of vehicle occupant safety.
- It is important to continue to compare NCAP results with real world crashes to validate consumer vehicle crash test programs. Research work conducted by MUARC on the correlation of ANCAP results with actual crash data is continuing (MUARC 1997).

- Compatibility between vehicles in different size categories is a very important issue for consumer occupant protection. The aggressivity of some types of vehicles, particularly 4WDs and vans, to other vehicle types is a major concern.
- Side impact testing has been introduced into the Euro and US NCAP crash test programs and is planned for Japan NCAP and ANCAP.
- ANCAP needs to further develop relationships with international NCAP groups, research organisations and vehicle manufacturers, both local and overseas.

ANCAP has provided consumers with the information necessary to make an informed decision on buying a new car on the basis of safety performance. This has generated market opportunities for the vehicle manufactures to produce and promote vehicles with improved crash test results. While the manufacturers' representative group has publicly criticised ANCAP, significant improvements in the crash test performance of new cars sold in Australia since the program commenced in 1992 have been able to measured.

ANCAP will continue to use consumer information to encourage vehicle manufacturers to further improve vehicle safety performance. ANCAP will also continue to consult with all stakeholders to ensure the ongoing relevance of the program.

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