INFLUENCE OF A PASSENGER DUMMY ON CONSUMER RATING IN OFFSET FRONTAL NCAP CRASH TESTING

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Paper No. 78

1. ABSTRACT

The offset frontal crash test used by both Australian NCAP (ANCAP) and EuroNCAP has both a front seat passenger and driver dummy while the offset frontal crash test used by the IIHS has only a driver dummy. Additionally Japan NCAP will also include the offset frontal test into their program.

All of these consumer crash test programs use the same basic test protocols for the offset frontal test based on the EEVC test which has been included as ECE R94/01, but at the higher test speed of 64 km/hr. However, one major difference between the ANCAP / EuroNCAP programs and the IIHS program is the use of a front seat passenger dummy.

This paper reviews influence of the passenger dummy on the NCAP ratings given to cars that have been part of both the ANCAP and EuroNCAP programs. This was done through an evaluation of the passenger dummy results from the ANCAP tests and the EuroNCAP tests and how these results were used in the evaluation process.

2. INTRODUCTION

From 1995 ANCAP included a 40 % offset frontal crash into a deformable barrier in accordance with the test protocols developed by the EEVC in 1993. This test was initially conducted at 60 km/hr, which was the speed for the proposed European regulations. However, ANCAP moved to conducting the crash tests at 64 km/hr to be consistent with the US IIHS who also started conducting consumer crash tests at this speed in 1995 and the developing EuroNCAP program, which also selected 64 km/hr.

The main difference between the ANCAP offset crash test and the IIHS test was that ANCAP used Hybrid III dummies in both the driver and passenger seats while the IIHS uses only a dummy in the driver's seat.

In 1999 ANCAP harmonised its test procedures and assessment protocols with EuroNCAP.

3. GOVERNMENT REGULATIONS

In Australia the regulation for offset frontal crash testing of passenger cars is Australian Design Rule 73/00 (ADR 73/00), based on the UN ECE Reg 94/01. New model passenger cars manufactured from 1 January 2000 and existing model passenger cars manufactured from 1 January 2004 must meet this rule.

ADR 73/00 is applicable only to passenger cars with a gross vehicle mass of less than 2.5 tonnes, ie. sedans and station wagons. The regulation does not apply to 4 wheel drive passenger cars, passenger vans, people movers or small utility vehicles.

Both ECE R94/01 and ADR 73/00 require the offset frontal test to be conducted at 56 –0 +1 km/hr and measure the success or failure of the test on both dummy performance and vehicle deformation criteria.

The dummy performance criterion, to be measured on both the driver and passenger dummy, includes;

- Head Performance Criterion (HPC),
- Neck Injury Criterion (NIC) defined via neck tension, neck shear over time and neck bending moment,
- Thorax compression criterion (ThCC),
- Viscous criterion (V*C),
- Femur force criterion (FFC),
- Tibia compression force criterion (TCFC),
- Tibia index (TI) and
- Movement of the sliding knee joint.

The early ANCAP tests published only HIC 36 (ie same as HPC) and chest compression on passenger dummies in offset tests. Latter tests also published femur compression results. These three values are considered in this paper.

Consequently, the values that are relevant to this analysis are the ADR 73/00 pass/fail limits; HPC of 1000, thorax compression of 50 mm and femur force of 9.07 kN at 0 ms and 7.58 kN at greater than 10 ms.

4. RESULTS OF ANCAP Crash Tests

When ANCAP introduced offset frontal crash tests in 1995 it was seen as a supplement to the full frontal

crash test that had been conducted since 1993. The test adopted was in accordance with the test protocols developed by the EEVC in 1993 and included a passenger dummy.

For this paper the HIC, chest compression and femur force (where recorded) measurements from the passenger dummies results of cars tested by the ANCAP were used. This allows comparison of the passenger dummy results from the offset frontal tests with the results from the full frontal tests conducted by ANCAP. In both the offset frontal and full frontal tests ANCAP used Hybrid III dummies.

The limits for ratings initially used by ANCAP are summarised in Table 1.

Table 1.
ANCAP Limits 1993 - 1996

Measurement	Low	Medium	High
HIC	< 750	750 to 1250	> 1250
Chest Compression	< 50 mm	50 to 75 mm	> 750 mm
Femur Compression	< 5 kN	5 to 10 kN	> 10 kN

The HIC and chest compression measurements recorded by the passenger dummy in all the offset frontal crash tests conducted by ANCAP are summarised in Tables A1 and A2 in Appendix A.

An analysis of these results the only cars with a HIC of more than 750 were from the original small car series conducted with vehicles built in 1993 and a 1994 Toyota Corolla.

All models tested since 1994 (except the Corolla) had a HIC of less than 750, which is substantially under the 1000 limit in the regulatory test and also the limit originally used by ANCAP, 750, for rating a low chance of sustaining a life threatening brain injury.

All chest compression measurements are less than 50 mm, which is the maximum allowable value in the regulatory test and also the maximum value used by ANCAP for rating a low chance of sustaining a life threatening chest injury. In some offset tests the passenger dummy chest compression result was greater than the driver dummy's result.

When the passenger dummy offset test results are compared with the corresponding full frontal test results, (see Tables A1 and A2) it can be seen that the offset frontal crash test is less severe on the passenger dummy head and chest injury measurement, than the full frontal test.

In the full frontal crash the ANCAP results showed passenger dummy HIC greater than 750 for cars built up until 1997. For these vehicles the passenger dummy HIC in the offset tests was low, with some in the order of 200 to 300.

The chest compression measurements of passenger dummies in both offset frontal and full frontal tests were all below 50 mm.

From 1998 ANCAP conducted crash tests where passenger dummy femur compression was measured in both full frontal and offset frontal tests. These results are summarised in Table A4.

The femur compression results from the full frontal tests were predominantly higher than those from the offset frontal tests. All test results were substantially lower than the regulatory limit of 7.58 KN.

Only 4 out of 22 femur compression results in the full frontal tests were recorded as higher than 5 kN but were still well below the maximum regulatory limits.

All offset femur compression results were lower than 5 kN, i.e. the ANCAP limit for rating a low chance of sustaining a leg injury. It is interesting to note that these results are also substantially below the regulatory limits despite the test being conducted at a higher speed, 64 km/hr, than the regulatory test speed of 60 km/hr.

5. EVALUATION PROCESS

a. Life Threatening Injury Risk

When ANCAP first published offset crash test results it used a risk of life threatening injury (LTIR) to give a relative measure of the level of occupant protection offered by a car. The LTIR was calculated using the similar injury risk index used by NHTSA for their NCAP program at that time.

ANCAP took this a step further by combining the results of both the full frontal and offset frontal test results in the same proportion as shown by Australian crash statistics to calculate the overall injury risk score.

For a front seat passenger the results of the full frontal test was used for 71% of the score while the offset frontal test was used for 29%. Therefore the

probability of the front seat passenger sustaining a life threatening injury was calculated from;

$$P(passenger) = 0.71P(full) \times 0.29P(offset) \quad (1).$$

b. IIHS Format

To improve the presentation of information, and take into account the structural performance of the car, in 1996 ANCAP moved to a rating system similar to that used by the IIHS. However, as the IIHS conducted only offset frontal tests and only with a driver dummy, it had measurements from only one dummy to consider while ANCAP had measurements from four dummies.

Consequently, ANCAP needed to adapt the rating system to achieve the best utilisation of the crash test results and present an accurate picture of the level of occupant protection offered by the crash tested car. ANCAP devised a system that considered the structural performance and injury measurements of both the full frontal and offset crash tests.

The limits used for the injury measurements for HIC and chest compression are summarised in Table 2.

Table 2.
Injury Measures 1996 - 1999

Measurement	Good	Acceptable	Marginal	Poor
HIC	<750	750 – 899	900 - 999	1000 or more
Chest Compression	<50 mm	50 – 59 mm	60 –74 mm	75 mm or more
Femur Compression	<7.3 kN	7.3 – 9 kN	9.1 – 10.8 kN	10.9 kN or more

From the summary of passenger dummy injury measurements (Tables A1, A2 and A4) it can be seen that these measures would result in "Good" values. These values then needed to be combined with the passenger dummy readings from the full frontal crash tests for a combined injury rating. To achieve a combined injury rating the worst injury measurement for the body region was used.

The offset passenger dummy results did not influence the overall rating, as its results for HIC, chest compression and femur compression were all "Good". Consequently, the overall result for the passenger dummy was taken from the full frontal test injury measures.

6. HARMONISATION WITH EURONCAP

a. Rating Protocols

When ANCAP decided to progress its program and include side impact and pedestrian testing, it achieved its best benefit through harmonisation with the EuroNCAP program. This included adopting the EuroNCAP rating and evaluation procedures.

The EuroNCAP rating procedures are biased towards the driver. Essentially, the EuroNCAP rating system calculates the overall rating using the driver score unless the passenger dummy did not perform as well.

The EuroNCAP rating gives 4 points to each of 4 body regions, head and neck, chest, upper leg and lower leg for a total of 16 points for the offset frontal test.

For the dummy measurements considered in this paper a maximum score of 4 points is given for the head if the HIC is less than 650, then modifiers such as unstable airbag contact are used to deduct points. The maximum chest score of 4 points is given if the chest compression is less than 22 mm and zero if more than 50 mm.

The chest compression rating used in EuroNCAP is more severe than that used by IIHS, NHTSA or previously by ANCAP.

The EuroNCAP rating procedures gives a maximum of 4 points if the femur compression is less than 3.8 kN. Each leg is rated separately and modifiers are applied if there is any contact between the knee and any part of the structure that could result in higher knee loadings.

The passenger and driver scores are then combined, using the lowest input values to give the score for each body region. The passenger head, chest or leg score are used in the rating where they are the lower than the driver's results.

EuroNCAP test procedures also measures a number of other criteria on the dummy including, head g, neck criterion, chest viscous criteria, knee joint displacement, tibia compression and tibia index and these are then used to derive the final score.

This paper does not consider these criteria due to an absence of data from full frontal crash tests.

b. Crash Test Results

The passenger HIC and chest compression results of the ANCAP cars tested to the EuroNCAP protocols and the EuroNCAP tested cars that are applicable to the Australian market are shown in Table A3.

These results again demonstrate low levels of HIC recorded in the passenger dummy with all HICs below 1000 and only one vehicle with a HIC above 650 (where maximum points are awarded). The majority of HIC results are between 200 and 400.

Chest compression measures are all below 50 mm and none is below 22 mm. In some tests the passenger chest deflection was greater than the driver's and this would result in a lower score under the EuroNCAP rating protocols.

One aspect of passenger dummy performance that ANCAP has started to report is dummy movement and whether the dummy strikes any part of the vehicle's interior during the crash test. In many tests the passenger dummy impacted the interior, with either the knees or head striking the dash or glove box.

The femur compression results from the passenger dummy in the cars tested with the EuroNCAP test procedures, Table A3, showed that only one out of the 38 femur compression results recorded was greater than 3.8 kN. This vehicle, a 1998 Daewoo Leganza had a femur compression force in the driver right leg of 16 kN.

Most femur compression results were substantially lower than 3.8 kN and 37 out of the 38 recorded results received 4 points prior to applying modifiers or considering knee joint displacement. Actually 21 results were less than 1 kN.

A review of ANCAP and EuroNCAP results show that the driver dummy upper leg results are usually higher than those of the passenger dummy. Consequently, the driver upper leg result is normally used for the input into the overall rating.

c. Influence of Body Region

The scores for each body region from the offset frontal crash tests of ANCAP cars tested to the EuroNCAP protocols and the EuroNCAP tested cars that are applicable to the Australian market are shown in Table A5.

Out of 21 vehicles, passenger dummy scores influenced 11 overall results. Eight of these were from the chest result, one from the head result, one from chest and upper leg results, and one from chest, upper leg and lower leg results.

The difference between the offset score rating including the passenger dummy and without the passenger dummy is normally very low with an average of less than one point.

There are three vehicles where the difference is greater than one point:

- 1998 Daewoo Leganza where the passenger's head struck the dash resulting in a high head acceleration and a corresponding low score of 0.9 while the driver's head score was 4.0,
- 1997 Holden/Vauxhall Vectra where the passenger's chest score was 1.15 less than the driver's,
- 2000 Peugeot 206 where the passenger's chest score was 1.109 less than the driver's.

It is interesting to note that in the vehicle where the passenger dummy results were worst than the driver's for chest, upper leg and lower leg the difference was still less than 0.5 points.

Out of the 42 passengers upper leg scores only 9 received less than the maximum 4 points. One result started with less than 4 points due to femur compression greater than 3.8kN.

Modifiers due to contact with the dash were used to deduct points for 5 of these results while 3 results had deductions due to knee displacement greater than 6 mm (where maximum points were awarded) and one had points deducted for both dash contact and knee displacement.

There were ten occurrences where the lower leg score was less than the maximum 4 points for the passenger dummy. However, all scored above 3 points and none influenced the final score.

Recalculating the overall star rating based on the driver result only shows the limited influence of the passenger dummy on the results. For the results summarised in Table A5 there would not be a change in any overall "star" rating.

7. JAPAN NCAP RATING

Japan NCAP introduced an offset frontal crash test into its program from 2000 using the same test protocol as the other NCAPs. Japan NCAP also has

both a driver and passenger dummy, but without any child dummies in the rear seat as in the ANCAP and EuroNCAP tests.

As well as continuing with the full frontal crash test Japan NCAP will also introduce the EuroNCAP side impact test, but at the higher test speed of 55 km/hr. Consequently Japan NCAP has developed a rating system to include results from the three types of tests.

The scoring system is essentially the same as EuroNCAP. However, the results will be rated by injury location to relate the result to the likelihood of injury or death. The driver rating will combine the full frontal, offset frontal and side impact tests.

The passenger rating will be derived from the full frontal test only. Essentially the offset frontal passenger result will be given a rating of 0.

8. DISCUSSION

In the 64 km/hr frontal offset crash into a deformable barrier that is used by ANCAP and EuroNCAP 40% of the front of the test vehicle makes contact with the barrier. This resulting crash places severe demands on the structure of the vehicle, especially on the driver's side.

The tests conducted by ANCAP and more recently, EuroNCAP, have shown that HIC and femur compression recorded on the passenger dummy are very low and have no influence on the overall rating given to the vehicle.

Passenger chest compression is often higher than the driver's and does contribute to the overall score. However, the results of the 21 cars that have been rated using the EuroNCAP rating protocols and considered in this paper, showed there was no contribution from the passenger dummy to the overall star rating.

Higher passenger dummy injury measurements are achieved in the full frontal test, which places higher loads on the restraint system.

It could be argued that a passenger dummy is not required in an offset test program that relies only on the dummy measurements for rating the vehicle, or even a program which combines both offset frontal and a full frontal tests.

However, one aspect of the offset frontal tests where the passenger dummy does provide benefits is the movement of the dummy during the crash test. This movement, and any consequent contact with the vehicle's interior, allows consumer crash test programs to identify interior structures that can be modified by manufacturers to reduce the severity or chance of injury in the event an occupant contacts the interior during a crash.

A review of the femur compression results in tests conducted by both ANCAP and EuroNCAP showed that even though the passenger dummy does strike the vehicle's interior the resulting dummy measurements are usually under the limits and maximum points are given. Modifiers are then applied which deduct points for the dummy's knees or head striking the dash or glove box.

That raises a series of questions;

- Are the limits currently used sufficient?
- Should the limits be lowered?
- Do recordings below these limits mean there is minimal harm to the vehicle occupants?
- Are more bio-fidelic dummies required?

These questions are beyond the scope of this paper.

9. CONCLUSIONS

From the information available it can be concluded that the passenger dummy in the offset frontal test has only a small influence in the overall NCAP rating given to a vehicle.

The tests conducted by ANCAP and more recently, EuroNCAP, show HIC, chest compression, and femur compression recorded on the passenger dummy are very low and have little influence on the overall rating given to the vehicle, especially a single figure "star " rating.

However, the movement of the passenger dummy and whether it strikes the interior of the vehicle provides valuable information.

When an NCAP program uses both a full frontal and an offset frontal test the passenger dummy results from the full frontal test are usually greater than the passenger dummy results from the offset frontal tests. Correspondingly, if the vehicle was going to be given an NCAP rating combining the results of both tests the passenger dummy could be eliminated from the offset test.

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APPENDIX A. RESULTS TABLES

Table A1.
ANCAP Small Car Results – Passenger (Driver)

Vehicle	Build Year	HIC		Chest Compression (mm)	
		Offset	Full Frontal	Offset	Full Frontal
Hyundai Lantra[1]	1993	840	2030	36 (47)	35
Ford Laser[1]	1993	1300	1790	43 (39)	-
Mitsubishi Lancer[1]	1993	790	1240	36 (33)	36
Mazda 121[1]	1993	1280	1070	43 (23)	34
Toyota Corolla[1]	1993	390	1220	27 (48)	36
Nissan Pulsar[1]	1993	810	1530	37 (42)	43
Hyundai Excel[1]	1993	710	860	36 (34)	37
Holden Barina[1]	1993	800	1150	29 (44)	38
Honda Civic[1]	1993	470	1100	40 (30)	41
Subaru Impreza[1]	1993	360	890	35 (43)	41
Daihatsu Charade[1]	1993	1330	1260	35 (35)	41
Ford Festiva[1]	1995	440	1430	34 (32)	37
Ford Laser[1]	1994	330	+	37 (43)	55
Holden Barina[1]	1994	400	1190	34 (33)	44
Hyundai Excel[1]	1994	340	+	29 (32)	41
Toyota Corolla[1]	1994	920	1300	33 (53)	39
Daewoo Cielo	1995	95	858	33 (36)	34
Holden Barina	1996	209	1102	30 (21)	38
Honda Civic	1996	542	777	31 (33)	44
Hyundai Lantra	1996	654	1319	36 (47)	40
Mitsubishi Mirage	1996	321	608	39 (30)	37
Nissan Pulsar	1995	429	1168	35 (32)	41
Toyota Starlet	1996	244	657	32 (34)	36
Daihatsu Charade	1996	580	960	39 (43)	47
Ford Laser / Mazda 323	1997	280	1390	38 (45)	51
Nissan Micra	1996	200	900	- (24)	37

Table A2.
ANCAP Large and Medium Car Results – Passenger (Driver)

Vehicle	Build Year	HIC		Chest Compression (mm)	
		Offset	Full Frontal	Offset	Full Frontal
Ford Falcon[1]	1994	380	1280	49 (35)	48
Holden Commodore[1]	1994	220	1110	39 (39)	45
Subaru Liberty[1] (passenger airbag)	1994	450	920	34 (32)	39
Subaru Liberty[1] (without airbag)	1994	300	1020	35 (42)	38
Toyota Camry[1]	1994	530	1350	36 (37)	41
Holden Commodore[1]	1996	538	1428	40 (35)	55
Honda Accord	1996	510	801	39 (42)	42
Mitsubishi Magna	1996	404	842	47 (34)	48
Toyota Camry	1995	286	1075	37 (40)	54
Holden Commodore	1997	406	710	43 (36)	44
Ford Falcon	1997	539	1280	48 (36)	48
Ford Falcon	1998	651	+	34 (27)	47
Toyota Camry	1997	297	760	39 (45)	43

Table A3.
Passenger Dummy HIC and Chest Compression Results from ANCAP and Euro NCAP Offset Tests

Vehicle	Build Yr	HIC	Chest mm	Femur		Comments
				L (kN)	R (kN)	
Daihatsu Sirion (A)	2000	232	28 (35)	0.35	1.4	Knees hit glove box
Hyundai Accent (A)	2000	245	26 (18)	0.2	1.8	Knees hit glove box and dash
Mazda 323 (A)	1999	433	34 (29)	0.65	1.38	Knees hit glove box and dash Head hit dash
Nissan Pulsar(A)	2000	387	35 (38.5)	0.3	2.4	Knees hit glove box. Head close to dash
Daewoo Nubira (A)	1999	389	34 (24)	0.58	3.35	Knees hit glove box. Head hit dash
Daewoo Lanos (A)	1998	249	28 (38)	1.7	2.1	Head glanced dash
Toyota Echo/Yaris (E)	2000	139	28 (28)	2.45	1.65	Legs hit dash
Mercedes A160 (E)	1999	383.5	23 (27)	0.11	0.33	
Audi A-3 (E)	1997	187	34 (29)	0	0	Chest protection could be improved
Holden/Vauxhall Astra (E)	1999	171	29.5 (36)	0.26	0.64	
Peugeot 206 (E)	2000	238	33 (25)	2.36	2.2	
VW Golf (E)	1998	180	38 (29)	-	-	
Toyota Corolla (E)	1997	283	31 (29)	-	-	Knee impact area hazardous
Peugeot 306 (E)	1997	277	32 (34)	0	0	
Ford Ka (E)	2000	326	32 (30)	1.28	0.87	
Daewoo Leganza (A)	1998	586	30.5 (40)	0.5	5.5	Knees hit glove box and dash Head hit dash
Subaru Liberty (A)	1999	284	32.5(32)	0.5	0.5	Knees hit glove box
Holden/Vauxhall Vectra (E)	1997	433	45 (37)	0.5	1.8	
Hyundai Sonata (A)	1998	732	40 (37)	0.5	1.8	Knees hit glove box and dash
Mazda 626	1998	213	30 (24)	1.0	3.1	Knees hit glove box and dash
Volvo S40 (E)	1997	216	31 (33)	0	1.5	

Table A4.
Passenger Dummy Femur Compression Results from ANCAP Tests

Vehicle	Build Year	Full Frontal Test		Offset Test	
		L (kN)	R (kN)	L (kN)	R (kN)
Suzuki Baleno	1998	1.4	2	0.7	1.9
Toyota Camry	1997	1.6	0.8	0.9	1.2
Holden Commodore	1997	0.4	1.2	0.2	0.9
Ford Falcon	1997	6.1	1.7	2.2	1.8
Ford Falcon	1998	1.3	4.0	0.8	2.7
Daewoo Lanos	1998	3.2	2.6	1.7	2.1
Mitsubishi Magna	1996	3.1	2.7	1.1	2.1
Kia Mentor	1998	2.4	1.8	0.8	1.8
Mazda Metro	1998	1.6	7.8	1.5	3.4
Daewoo Nubira	1998	2.7	3.0	1.2	3.1
Daihatsu Sirion	1998	5.3	5.3	4.3	2.0

Table A5.
Offset Crash Test Scores – Using EuroNCAP Rating

Vehicle		Build Yr	Head/Neck Score	Chest Score	Upper Leg Score Left	Upper Leg Score Right	Lower Leg Score Left	Lower Leg Score Right	Overall
Daihatsu Sirion (A)	D	2000	4.0	2.057	4.0	2.378	3.50	0.0	8.435
	P		4.0	3.114	4.0	3.956	3.867	4.0	
Hyundai Accent (A)	D	2000	4.0	4.0	3.0	4.0	1.20	4.0	10.756
	P		4.0	3.40	4.0	2.156	4.0	3.556	
Mazda 323 (A)	D	1999	2.0	2.239	3.0	2.945	1.844	0.0	7.184
	P		4.0	2.271	4.0	4.0	4.0	4.0	
Nissan Pulsar (A)	D	2000	0.733	0.0	0.0	0.343	2.467	0.0*	0.733
	P		4.0	2.057	4.0	2.0	4.0	4.0	
Daewoo Nubria (A)	D	1999	2.0	1.719	1.034	1.009	1.813	0.0	4.728
	P		4.0	2.239	4.0	4.0	4.0	3.60	
Daewoo Lanos (A)	D	1998	0.0	0.306	0.0	1.469	3.378	0.0	0.306
	P		4.0	3.114	4.0	4.0	-	-	
Toyota Echo/Yaris (E)	D	2000	4.0	3.194	2.0	2.0	3.867	3.813	12.529
	P		4.0	3.187	1.564	4.0	3.778	4.0	
Mercedes A160 (E)	D	1999	4.0	3.307	2.0	2.0	1.956	2.433	11.263
	P		4.0	3.854	4.0	4.0	4.0	4.0	
Audi A-3 (E)	D	1997	4.0	3.0	2.0	1.022	4.0	2.08*	9.388
	P		4.0	2.286	4.0	4.0	4.0	4.0	
Holden/Vauxhall	D	1999	3.687	1.941	4.0	4.0	4.0	3.80*	13.428
Astra (E)	P		4.0	2.923	4.0	4.0	4.0	4.0	
Peugeot 206 (E)	D	2000	4.0	3.583	3.0	2.0	4.0	2.040*	10.514
	P		4.0	2.474	2.0	2.0	4.0	4.0	
VW Golf (E)		1998	4.0	3.0	3.0	3.0	1.556	1.040*	10.090
	P		4.0	2.050	4.0	4.0	3.2	3.956	
Toyota Corolla (E)	D	1997	3.812	3.0	2.0	2.0	4.0	1.80*	10.391
	P		4.0	2.779	4.0	4.0	4.0	3.933	
Peugeot 306 (E)	D	1997	3.0	0.826	0.937	2.0	2.960	3.556	7.723
	P		4.0	2.571	4.0	4.0	4.0	4.0	
Ford Ka (E)	D	2000	3.0	2.856	1.924	0.130	0.311	0.0*	5.669
	P		4.0	2.539	3.0	3.0	3.644	4.0	
Daewoo Leganza (A)	D	1998	4.0	0.0	0.72	0.0	0.0	0.4	0.90
	P		0.90	2.79	4.0	2.71	3.87	3.38	
Subaru Liberty (A)	D	1999	4.0	2.60	4.0	4.0	2.58	3.78	13.08
	P		4.0	2.50	4.0	4.0	4.0	4.0	
Holden/Vauxhall	D	1997	3.37	1.86	4.0	4.0	3.56	0.0	8.08
Vectra (E)	P		4.0	0.71	4.0	4.0	4.0	3.47	
Hyundai Sonanta (A)	D	1998	0.0	0.0	0.0	1.72	0.0	0.42*	0.0
	P		3.06	1.49	4.0	4.0	4.0	3.93	
Mazda 626 (A)	D	1998	4.0	3.33	0.0	2.33	0.53	0.0*	6.89
	P		4.0	2.89	4.0	4.0	4.0	4.0	
Volvo S40 (E)	D	1997	4.0	2.43	4.0	4.0	1.78	1.44*	11.87
	P		4.0	2.71	-	4.0	4.0	4.0	

Notes: 1. Offset test conducted at 60 km/hr. All other offset tests conducted at 64 km/hr.
+ Significant head to knee impact
(A) ANCAP test, (E) Euro NCAP test
Driver chest deflection figures in brackets in Tables A1, A2 and A3.
In Table A5 D is Driver and P is Passenger scores.
* Denotes modified score from brake pedal movement in Table A5.
Shaded scores in Table A5. Is where passenger score used in overall keep count.