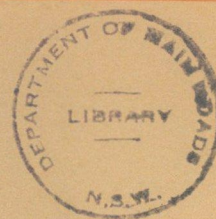
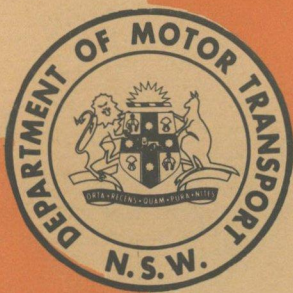


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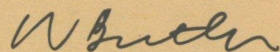


CHILD RESTRAINT
FIELD STUDY

B.A. VAZEY, M.E.

The Traffic Accident Research Unit was established within the Department of Motor Transport, New South Wales, in May 1969 to provide a scientific approach to the traffic accident problem.

This paper is one of a number which report the results of research work undertaken by the Unit's team of medical, statistical, engineering and other scientists and is published for the information of all those interested in the prevention of traffic accidents and the amelioration of their effects.

A handwritten signature in dark ink, appearing to read 'W. Butler', is centered on the page.

Commissioner.



L073020



CHILD RESTRAINT FIELD STUDY

(PROJECT REPORT ON "IMPACT-3")

B.A. VAZEY, M.E.

TRAFFIC ACCIDENT RESEARCH UNIT,
DEPARTMENT OF MOTOR TRANSPORT,
NEW SOUTH WALES.

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The assistance of the following in various aspects of the study is gratefully acknowledged:

- * The N.S.W. Ambulance Board.
- * The N.S.W. Police Department.
- * The Staff of district police stations.
- * The Health Commission of N.S.W.
- * The Medical Superintendents and Medical Records Librarians at the Admission Hospitals.

Special note must be made of the co-operation of the public whose children were the subjects of the study. Their consent to be interviewed, their helpfulness in providing crash and medical detail and their permission for hospital records to be examined were essential to the success of the study.

ABSTRACT

This report deals with an in-depth study of 149 children who were ostensibly restrained in preparation for crashes, and who actually experienced collisions of the passenger cars in which they were travelling. Children in child restraints approved by the Standards Association of Australia received nothing worse than minor injury. Similarly, restrained bassinets gave moderate protection. Seat belts supplied for adults tended to be worn very loosely by children and in that condition did not provide adequate restraint.

Most of the injuries sustained were to the head region following contacts with car interiors. Recommendations are made for improving crash protection.

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INTRODUCTION

In the year ended December 31, 1974, there were 23 fatalities reported¹ in New South Wales to vehicle occupants aged less than 5 years. They represented 5.24 fatalities for every 100,000 children aged less than 5 years estimated² to have been amongst the New South Wales population at June 30, 1974. In addition, 495 vehicle occupants aged less than 5 years were reported injured, representing 2.08 injured per 1,000 such children.

Attempts to reduce the casualty rates for all occupants have included many measures aimed at reducing the frequency and severity of crashes. These measures help young children along with the older occupants. The recent development of, and legislation for, seat belts has had substantial overall benefits³, however the small number of young children who died as vehicle occupants has prevented any statistical analysis comparable to those which have indicated the benefits of belts for the adult population. While the quality and wearing of adult seat belts has become controlled by law in New South Wales, the legislation did not, at the time of the IMPACT 3 project, extend to child restraints and specifically excluded children under 8 years of age. Croft has found⁵ in metropolitan surveys that 70% of child occupants were unrestrained. The Standards Association of Australia has specified design standards for child restraints through its Australian Standard E46-1970⁴, subsequently revised and issued as AS1754-1975¹⁵. Restraints complying with these Standards have been certified by the Association, but there has only recently been any legislated restriction in New South Wales against the sale of restraints which are not certified.

In addition to dynamic testing of child restraints using anthropometric dummies and a crash simulating sled^{6,7}, the Traffic Accident Research Unit has, over several years, made special studies of a number of crashes in which young children died while believed to have been wearing a restraint. The limitations of these two means of appraising child restraints were, respectively, that laboratory tests with dummies could allow estimates of forces and excursions, but could not predict injury, owing to a lack of data about the capacity of young children to withstand forces, and that there have been very few cases of children dying while wearing child restraints.

The IMPACT 3 project was an in-depth field study of crashes undertaken to obtain some indication of the extent to which young children were being assisted by restraints, to indicate practical problems with them, and to guide selection of future priorities for the

development of crash protection for children. The project followed IMPACT 1, a study of fatalities among adult wearers of seat belts⁸, and operated concurrently with IMPACT 2, a study of hospitalized adult wearers of seat belts⁹.

IMPACT 3 commenced with a crash which occurred on January 27th, 1974. The last crash included in the study took place on 17th May, 1975. A preliminary report¹⁰ on some of the crashes has already been presented.

METHOD

New South Wales police in metropolitan divisions were instructed by their Department to notify by telephone of any investigated crash where

- * a child aged under 8 years was an occupant (not necessarily restrained)
- * the vehicle carrying the child was towed from the scene.

In spite of substantial efforts by all concerned the notification system for the concurrent project, IMPACT 2, revealed a steady stream of eligible cases which had not been reported to the IMPACT 3 team. During the latter half of the study there was heavy reliance upon mention of children in the reports submitted by ambulance officers to Central District Ambulance, Sydney.

The Central District Ambulance, and the Metropolitan Police Districts, were geographically similar, both including all of metropolitan Sydney and extending for about 80 km from the Sydney General Post Office.

Whenever possible, investigation of a prospective case commenced with an interview with the driver of the vehicle carrying the child or children. The question of protection was raised early in the interview. If some deliberate attempt was claimed by the driver to have been made to protect a child aged under 8 years from injury then a detailed interview followed and inspections were made of the vehicle carrying the child and of the restraint worn by the child. Where the child had been treated in hospital, parental permission was sought for access to hospital records. In serious cases this permission was used to allow the research medical officer personal access to relevant hospital records. In other cases, hospitals responded to written requests with written descriptions of injuries. The IMPACT 3 team used similar techniques and personnel to those described elsewhere^{8,9} for IMPACT 1 and IMPACT 2.

RESULTS

Police notified the IMPACT 3 field team of 54 crashes which were to become accepted as cases. There were 68 cases notified through reports by ambulancemen. The 122 cases each involved a vehicle which was towed from the scene and which included amongst its occupants a child or children aged under 8 years for whom protection had been attempted. There were 149 such children (case occupants) in the 122 case vehicles of the study.

THE ENVIRONMENT

The speed limit was 60 km/h or less at the scene of 106 crashes and more than 60 km/h at the scene of 16 crashes. The time of day and day of week of the crashes were distributed as shown in Table 1.

Time of Day	Numbers of IMPACT 3 crashes		
	Saturday and Sunday	Monday to Friday	TOTAL
Mid-night to 6 a.m.	3	0	3
6 a.m. to mid- day	8	30	38
Mid-day to 6 p.m.	18	29	47
6 p.m. to mid- night	13	21	34
TOTAL	42	80	122

TABLE 1: Times of crashes

THE CASE VEHICLES

The drivers of case vehicles were mothers to 70 case occupants, fathers to 66, some other relatives to 10 and non-relatives to 3 case occupants.

Exterior damage to case vehicles was described with the system already described⁸ for IMPACT 1 and IMPACT 2. The directions of the major collision forces, that is the forces that led to maximum damage rating in each crash, were distributed as shown in Table 2.

Direction of major collision force		Number of case vehicles
Frontal	11 o'clock	11
	12 o'clock	37
	1 o'clock	8
		56
Right side	2 o'clock	7
	3 o'clock	9
	4 o'clock	0
Left side	8 o'clock	3
	9 o'clock	17
	10 o'clock	6
		42
Rear	5 o'clock	2
	6 o'clock	19
	7 o'clock	1
		22
Above		2
		2
TOTAL		122

TABLE 2: Directions of major collision forces

Damage to the exteriors of case vehicles was rated using a scale applied also to case vehicles of IMPACT 1 and IMPACT 2. A definition of the scale is given in Reference 8, and the distribution of the ratings is given in Figure 1.

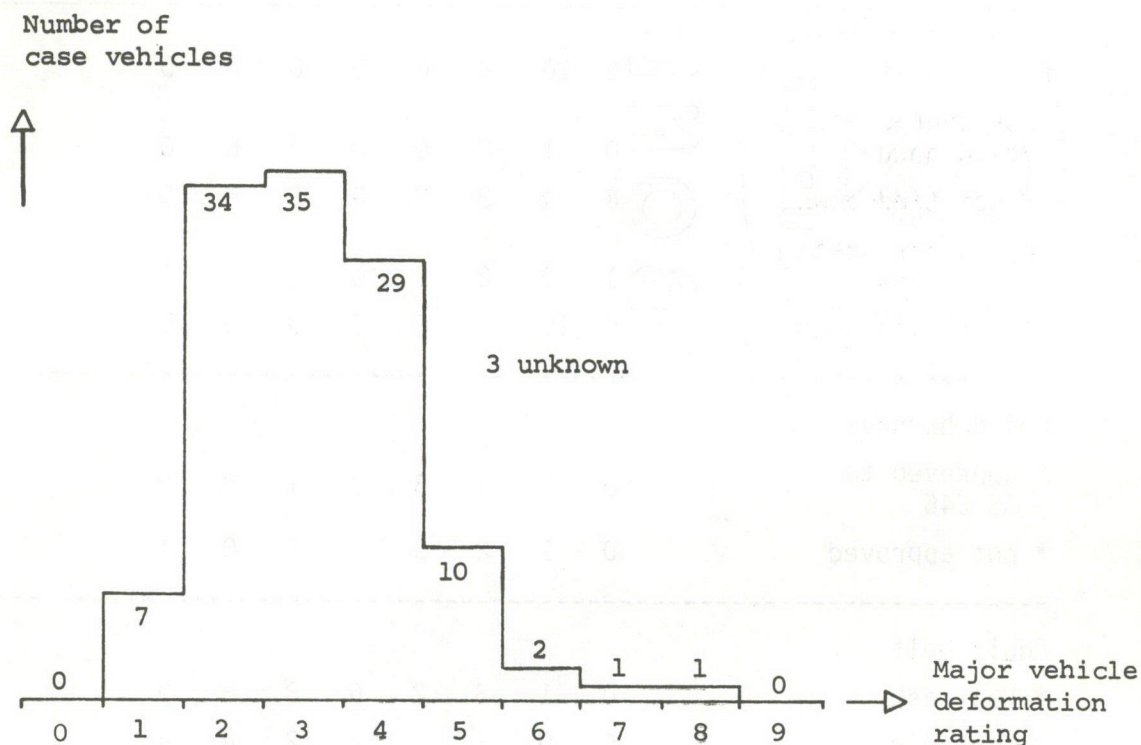


FIGURE 1: Distribution of major vehicle deformation ratings.

The case vehicle overturned in 10 of the crashes. Crash damage resulted in intrusion of interior surfaces of the occupant compartment in 57 case vehicles. It was estimated that 24 of the case occupants were within reach of these intrusions. Details of cases 69 and 70 in which major vehicle deformation exceeded 4 are included in Appendix A. Details for the other 12 such cases are given in Appendix B.

CASE OCCUPANTS AND RESTRAINTS

There were 83 male case occupants and 66 females. The systems used to protect them were grouped for this report according to

superficial similarities. Descriptions of the groups are given in Appendix C.

The ages of case occupants, and the kinds of restraints used by them were distributed as shown in Table 3.

Type of restraint	Age of case occupants (whole years)								TOTAL
	0	1	2	3	4	5	6	7	
Bucket seat	6	10	8	0	0	0	0	0	24
Hook-over seat:									
* tied down	0	1	0	0	0	0	0	0	1
* not tied down	4	4	3	2	0	0	0	0	13
Hook-under seat:									
* tied down	1	2	2	2	0	0	0	0	7
* not tied down	0	10	7	0	0	0	0	0	17

Child harness									
* approved to AS E46	0	0	2	3	2	1	0	0	8
* not approved	0	1	2	3	1	2	0	1	10

Adult belt									
* Lap/sash	0	1	3	2	6	8	8	9	37
* Lap only	0	0	3	3	1	2	0	4	13
* Sash only	0	0	0	0	0	1	0	1	2

Basket									
* tied with adult belt	6	0	0	0	0	0	0	0	6
* tied with other straps	3	0	0	0	0	0	0	0	3
* Not tied	8	0	0	0	0	0	0	0	8

TOTAL	28	29	30	15	10	14	8	15	149

TABLE 3: Types of restraints and ages of case occupants

All 17 children in baskets were aged less than 7 months. The other 11 children aged under 1 year all rode in child seats and were all aged 6 months or more.

In those cases where a child had been wearing an adult belt, measurement of belt adjustments was made, if possible, using a measuring rig placed in the child's seating position, and following a procedure described in the report⁹ on IMPACT 2. The results of the measurements of lap belt adjustment are given in Figure 2 for comparison with those given in Reference 9.

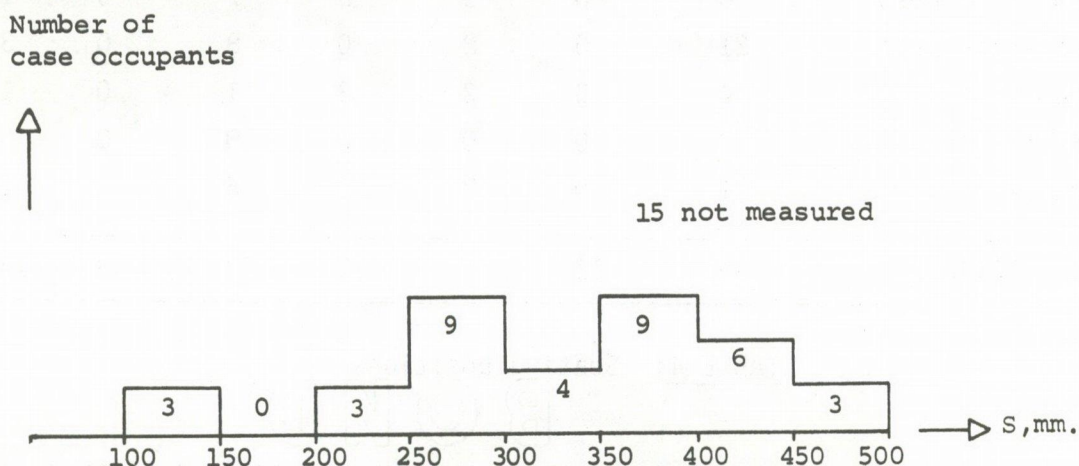


FIGURE 2: Distribution of S, the distance between the foremost part of the lap belt and the rear of the measuring rig, taken to indicate seat belt looseness

The 3 case occupants for whom seat belt looseness, S, was less than 150 mm all experienced frontal crashes with vehicle damage rated at 3 or 4. One aged 2 years and one aged 4 years were uninjured. The third, a 5 year old, sustained minor facial injuries which appeared to correspond with damage to the upper dashboard. It was difficult to reconcile these with the driver's statement that the child had not ejected out of the restraint, and language difficulties noted by the team gave further reason to dispute the facts of this case.

Seating positions occupied by case occupants were distributed as shown in Table 4.

Kind of Restraints	Seating Positions						TOTAL
	Front Left	Front Centre	Rear Left	Rear Centre	Rear Right	Goods Area	
Bucket seat	0	0	8	14	2	0	24
Hook-over seat	5	6	1	2	0	0	14
Hook-under seat	2	2	9	7	4	0	24
Child harness	0	0	9	2	7	0	18
Lap/sash belt	21	0	8	0	8	0	37
Lap belt	4	3	2	3	1	0	13
Sash belt	2	0	0	0	0	0	2
Basket	1	0	2	5	6	3	17
TOTAL	35	11	39	33	28	3	149

TABLE 4: Seating positions

There were 4 case occupants who were raised up from their car seats with cushions. All 4 occupied rear seats; further details are given in Table 5.

Case Occupant Number	Child age (whole years)	Kind of restraints	Child's height (m)	Case Vehicle
20/2	3	Harness (approved to AS E46)	1.07	Holden Kingswood
23/2	5	Lap/sash belt	1.07	Holden Monaro
39/1	2	Harness (not approved)	0.80	Morris Minor
108/2	2	Lap belt	0.94	Ford Cortina

TABLE 5: Details of case occupants using cushions

There were 18 case occupants who either ejected out of their restraint or else had their restraint detach from the vehicle. In 4 cases the child ejected out of the car, in the other 14 they came to rest inside the car. There were 10 further case occupants for whom ejection or detachment was an unconfirmed possibility. The types of restraints involved in ejections or detachments are shown in Table 6.

Type of restraint	Remained restrained and attached	Ejected from restraint or restraint detached	Partial or not known	TOTAL
Bucket seat	23	0	1	24
Hook-over seat	11	2	1	14
Hook-under seat	15	6	3	24
Child harness	17	0	1	18
Lap/sash belt	30	5	2	37
Lap belt	10	2	1	13
Sash Belt	1	0	1	2
Basket restraint (SS101)	2	1	0	3
Basket tied with adult belt	5	1	0	6
Basket not tied	7	0	1	8
TOTAL	121	17	11	149

TABLE 6: Details of disconnections from cars

In the case of baskets which were not tied, a child was taken to have remained restrained where he or she remained inside the basket and the basket remained essentially where it had been before the crash.

The ejection of case occupant 92/1 from a basket restraint (Safe-N-Sound SS101) involved a side crash and no rollover. The 6 months old baby came to rest on the parcel shelf with lacerations to the back of the scalp. Several canerods of the bassinet broke, possible from contact with intrusion. The child had been lying with his head towards the point of impact.

The ages of the 7 children escaping from adult belts were, 7 years:1, 6 years:1, 5 years:2, 3 years:1, 2 years:1, 1 year:1.

Case occupant 78/1, seated in a bucket seat, had the lower of the three attaching straps torn free as the bucket seat was forced forward by collapse of the rear seat backrest of the station wagon in which she rode.

IMPROVISATION

Some 29 case occupants were restrained with systems which included some improvisation. The types of improvisation are summarised in Table 7.

	Number of case occupants
Adult belt used to tie down hook-under seat	6
Adult belt used to tie down hook-over seat	1
Child harness used to tie down hook-under seat	1
Wedges used to incline bucket seat	2
Basket attached to adult belt	6
Basket jammed in position	3
Basket loose but surrounded closely	5
Adult belt shared by 2 occupants	5
TOTAL	29

TABLE 7: Kinds of improvisations used to restrain case occupants

None of the cases in which adult belts were used involved confirmed unlatching or disconnection of the adult belt from the car, however the lap belt used to restraint the hook-under seat of case 1/1 slipped approximately 250 mm at an adjuster, apparently due to the adjuster resting against the steel frame of the child seat.

INJURIES

No case occupant was fatally injured. There were eight case occupants admitted to hospital, with four staying at least seven days. Injuries were rated on the Abbreviated Injury Scale¹¹. With this scale AIS scores from 0 to 6 were allocated for each of six body regions. The numbers of case occupants with each score in each region are shown in Table 8.

Body Region	A.I.S.						
	0 Nil	1 Minor	2 Moderate	3 Severe	4 Serious	5 Critical	6 Maximum
General	149	0	0	0	0	0	0
Head	93	47	5	4	0	0	0
Neck	144	5	0	0	0	0	0
Chest	149	0	0	0	0	0	0
Abdomen	143	5	0	0	0	1	0
Pelvis	149	0	0	0	0	0	0
Extremities	139	9	0	1	0	0	0

TABLE 8: Injury pattern.

One child can be seen in Table 8 to have been critically injured. He was case occupant 70/1, and Figure 3 shows that he was seated within reach of massive intrusion flowing from a pole impact. It is probable that this 6 year old boy who was wearing a loosely adjusted lap/sash belt, sustained all of his injuries from contact with the intruding metal. He received an AIS of 5 to the abdominal region and an AIS of 3 to the extremities region. Further details of case occupant 70/1 are given in Appendix A, as are details of the other nine children with moderate injuries or worse (AIS 2 or more).

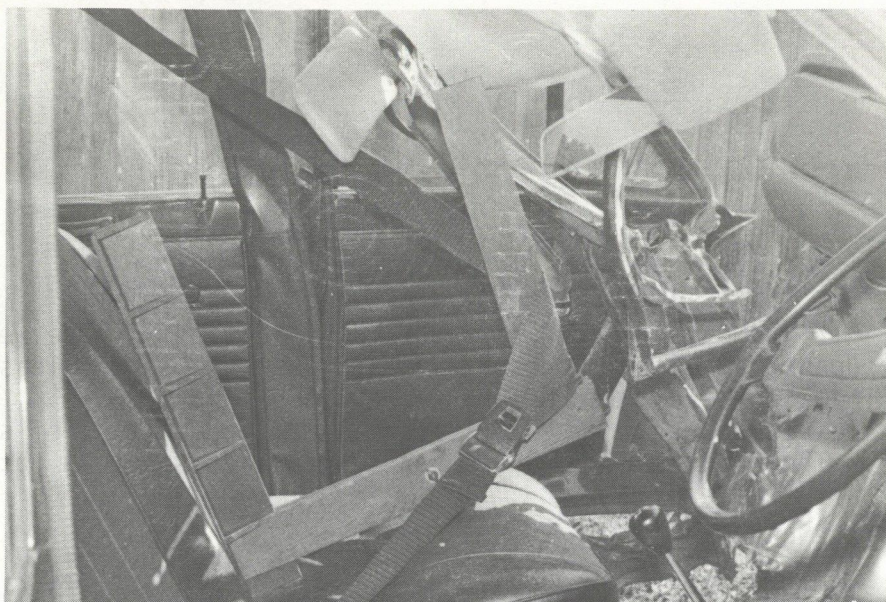


FIGURE 3: Measuring rig placed in seat belt worn by case occupant 70/1.

It is noteworthy that 9 of the 10 children who received moderate or worse injury scores received them in the head region (which includes the face). Five of these had been occupying adult seat belts, 3 had been occupying hook-over seats, and 1 had occupied a hook-under seat.

An analysis of all the recorded head injuries, including those rated minor, is given in Table 9. The injured are divided into four groups in the table according to whether or not their restraint detached from the car, whether or not they ejected out of their restraint, or whether or not they were seated close to threatening surfaces. It should be noted that in some cases, the child's injury may have been due to more than one of these factors, and that the table is structured to emphasise child restraint deficiencies. In fact, 7 of the 14 case occupants listed under "Yes, restraint detached" or "Yes, child ejected" may well have been hurt no matter which restraint type had been used simply because 4 of them were seated alongside the crash and 3 others were within easy* reach of intruding metal. Altogether, 13 of those with head injuries were seated alongside the crash and 8 others were within easy reach of intrusion.

Failure of a catch retaining the backrest of the rear seat in a station wagon led to the seat back folding onto the bucket seat shown in Table 9 to have detached from its car (case 78/1).

* The assessments "within easy reach of intrusion" were based on laboratory tests⁷ of restraints that indicated typical head space needs of about 0.5m each side of a child's centre and about 0.4m forward of a child's back.

A case occupant was classified as "alongside the crash" if he occupied a left side seating position in a crash with crash forces in 8, 9 or 10 o'clock directions, or occupied a right side seating position in a crash with crash forces in the 2, 3 or 4 o'clock directions.

Type of restraint	Head region injury recorded? (AIS 1 or more)					Total
	No, head not injured	Yes. Child restraint detached from car?				
		Yes, restraint detached from car.	No, or not known. Child ejected out of child restraint?			
			Yes, child ejected out of restraint	No, or not known. Child seated alongside crash, or within easy reach of intrusion?		
				No (d)	Yes (e)	
(a)	(b)	(c)	(d)	(e)		
Bucket seat	18	1	0	1	4	24
Hook-over seat: * tied down	0	0	0	1	0	1
* not tied down	7	1	1	3	1	13
Hook under seat: * tied down	5	0	0	1	1	7
* not tied down	10	4	0	2	1	17
<hr/>						
Child harness						
* approved to AS E46	7	0	0	1	0	8
* not approved	8	0	0	2	0	10

(Cont.)

Type of restraint	Head region injury recorded? (AIS 1 or more)					Total
	No, head not injured	Yes. Child restraint detached from car?				
		Yes, restraint detached from car.	No, or not known. Child ejected out of child restraint?			
			Yes, child ejected out of restraint	No, or not known. Child seated alongside crash, or within easy reach of intrusion?		
				No (d)	Yes (e)	
(a)	(b)	(c)	(d)	(e)		
Adult belt						
* Lap/sash	21	0	4	8	4	37
* Lap only	7	0	2	4	0	13
* Sash only	0	0	0	1	1	2
<hr/>						
Basket						
* tied with adult belt	4	0	0	1	1	6
* tied with other straps	0	0	1	1	1	3
* Not tied	6	0	0	2	0	8
TOTAL	93	6	8	28	14	149

TABLE 9: Analysis of head injuries

NOTIFICATION SOURCE

The degree of injury of those occupants who were notified by police and by ambulance officers was distributed as follows:

Maximum AIS	Source of notification		TOTAL
	Police	Ambulance	
0	48	34	82
1	9	48	57
2	3	2	5
3	3	1	4
4	0	0	0
5	0	1	1
6	0	0	0
TOTAL	63	86	149

TABLE 10: Injuries to case occupants notified by police and by ambulance

DISCUSSION

The attempt in IMPACT 3 to investigate crashes in which restrained children were carried as occupants encountered a problem of incomplete notification. Experience with IMPACT 1 - a study of adult fatalities, IMPACT 2 - a study of serious adult injuries, and IMPACT 3 - a study of restrained children not necessarily injured, suggests that it becomes increasingly more difficult to obtain reliable fast notification of incidents when coverage is sought of cases where people are not killed, and even more where one seeks to cover a select group who are not necessarily injured. An unknown proportion of prospective IMPACT 3 cases was not investigated. Since the exclusions were uncontrolled it is possible that particular kinds of crashes, particular types of restraint or particular groups of children were discriminated against in the notification process. No such discrimination has come to notice, however.

The 86 crashes notified by ambulancemen all involved carriage of a case occupant in an ambulance. It will be seen in Table 10 that those case occupants notified by ambulance officers more frequently had a maximum AIS of 1, than did those notified by the police. This is possibly merely a consequence of the fact that a child carried in an ambulance generally was taken to a hospital and hence had minor injuries better documented than the child who went straight home.

MAKESHIFT RESTRAINT

The improvisation listed in Table 7 deals with 29 of the case occupants. In addition to those listed might be added those 41 who used non-approved child restraints since there is little evidence from which to suppose that these offer real protection. A survey^{1,2} of child restraint usage also revealed a high incidence of modifications and wide usage of non-approved restraints.

The popularity of non-approved and improvised restraints points, in the case of young babies, to a lack of suitable restraint and, in the case of older children, to a need for the public to be better informed about the need for testing of designs. Laboratory testing^{6,7} and field work reported here, have demonstrated inadequacies in several designs which have been accepted by many users.

RESTRAINT FORCES

Much of the current approach to the restraint of children is based upon laboratory simulation of crashes using anthropometric dummies which are supposed to represent children. Appraisals have generally sought avoidance of the following two broad mechanisms of injury.

1. Impact between the child's body, especially head, and the car interior or beyond.
2. Loadings of the child's throat or abdomen through misplaced restraint webbing.

IMPACT 3 certainly supports the first concern; all of the important injuries to case occupants having arisen from their reaching car surfaces, or beyond. The second concern, that children might be injured by restraint loadings, was not reinforced much by the IMPACT 3 cases. While it would be unwise to ignore restraint forces in developing further restraints, the emphasis in the future development of child restraints should be towards limiting excursions, particularly of the head, still further than was achieved by the old Standard AS E46. (The new one may achieve this).

INTRUSION AND HEAD SPACE

The vehicle intrusion of case 70, in which a child received critical abdominal and severe leg injuries, is an example of a problem which appears to be beyond the scope of child restraints. Any restraint short of a non-collapsible enclosing cocoon leaves an occupant vulnerable to injury from massive intrusion.

The 56 children who received a head injury included 13 seated alongside the crash side of their car and 8 others assessed to have been within easy reach of intrusion. (14 are shown in column (e) of Table 9. A further 7 escaped from attachment to their car, and thus are included in columns (b) and (c)). In these 21 cases it appeared unlikely that any existing restraint could have protected the child from injury. The problem of children's seating space being invaded by, or close to, car surfaces is shared by adults. Both the IMPACT 1, and IMPACT 2 projects encountered proximity to sides, or intrusion, as a frequent source of occupant injury.

INVOLVEMENT OF VARIOUS TYPES OF RESTRAINT

Apart from the one case of critical injury, mentioned above, all moderate or worse injuries involved the head region. Comparison of restraints has therefore been based upon the analysis of head injuries which is summarised in Table 9. Comparison of child restraints approved to AS E46 with those not approved (excluding baskets) reveals that of 31

occupants using approved restraints, 7 sustained head injuries, and of 101 occupants using non-approved child seats, harnesses, and adult belts, 42 sustained head injuries. A tendency towards more frequent head injury for occupants not using approved child restraints is indicated but is not statistically significant ($\chi^2 = 2.90$, $.05 < p < .10$).

The three columns (b), (c), and (d) of Table 9 "Yes, restraint detached", "yes, child ejected", and "Child seated alongside crash, or within easy reach of intrusion? - no" are those which point to child restraints which failed to keep occupants confined to a reasonably small space during the crashes. The 42 cases in these columns included 37% of those who had been wearing adult belts, 34% of those in hook-over or hook-under child seats, 29% of those in baskets, 17% of those in harnesses, and 8% of those who had been seated in bucket seats. The small numbers of cases do not permit comparisons between unapproved and approved harnesses, nor between the different arrangements for restraining baskets. Neither do the numbers permit confident extrapolations to the general population, particularly in view of the possible effects of different age and seating position patterns for the different kinds of restraint, and reservations already expressed about the representativeness of IMPACT 3. However the indications are strong that bucket seats and child harnesses do provide superior protection to that from hook-over and hook-under seats, and from adult belts. It is noteworthy that the 10 occupants with moderate injury or worse comprised 6 who had worn adult belts and 4 who had occupied hook-over or hook-under seats.

ADULT BELTS

Most of the adult belts worn by case occupants were adjusted very loosely. Figure 2 shows the distribution of measures of lap belt looseness, and reveals a distribution not unlike that found⁹ for the generally loosely adjusted belts of IMPACT 2. Only 3 of the 37 for whom measurements were made appeared to have the lap portion of their belt tight. The effectiveness of tight adult belts was indicated by 2 of those, and observations and statements in a third seemed contradictory.

Ejection of 7 children from adult belts was recorded. In Table 9, ejection from an adult belt was associated with head injury scored AIS of 1 or more, in 6 cases. Thus, when worn very loosely, as typically was the case in IMPACT 3, an adult belt cannot be considered to provide adequate restraint for a child. (This comment applies also to adults.)

A recommendation tentatively proposed by Synder¹³ that adult belts should be used by young children where properly designed child restraints are unavailable remains appropriate. It also remains

tentative, however, and should, in the absence of firm data to the contrary, be qualified to recommend only firmly adjusted adult belts.

Australian Design Rule 4B¹⁴ specified emergency locking retractor seat belts for outer front seats of cars manufactured from 1st January, 1975. Table 4 shows that 27 of the 52 case occupants wearing adult belts were seated in the front left seat, indicating that about one half of the child wearers of adult belts might in future be found to be wearing automatically adjusting seat belts. While one may speculate that young children should be better protected by these automatically adjusting belts, this should not be taken for granted, and further field work is desirable to check that child wearers of emergency locking seat belts are satisfactorily restrained.

HOOK-OVER AND HOOK-UNDER SEATS

The 6 devices shown in the Table 9 analysis of head injuries to have separated from attachment to case vehicle included 5 hook-under or hook-over restraints. A further 8 hook-under or hook-over restraints are indicated in Table 9 to have failed to confine their occupants to a reasonably small space during the crashes. Only 2 of these 13 devices were tied down to the car with an adult belt. The prevalence of untied hook-under and hook-over restraints amongst those used by injured occupants came as no surprise following laboratory demonstrations⁷ of inadequacies in these devices.

There is one make of hook-under seat which has approval to AS E46 for use when tied to the car with an adult seat belt. This particular model was not represented in IMPACT 3. The tie-down concept does assume that an adult belt will perform satisfactorily in conjunction with a child restraint. The slippage of a buckle noted for the belt used for case occupant 1/1 ("Improvisation" section) points to a need to test the realism of that assumption. While no buckle opening was discovered in IMPACT 3, laboratory testing⁷ demonstrated that adult seat belt buckles can open when they strike against child restraint hardware.

NOTEWORTHY SURVIVALS

Appendix B records 12 severe crashes which were survived without very threatening injury. Case occupants 26/1 and 89/2 were in baskets which were on rear seats and not tied down. Case 37 involved 2 non-approved harnesses. Case 89, in addition to the basket mentioned above, included a lap/sash belt. Case 107 involved a bucket seat. Case 125

involved a harness approved to AS E46. Each of these crashes presented a severe test of the restraint and in each case injuries to the case occupants were either non-existent or were limited to abrasions or minor contusions.

Case 45 involved a fatality to the case occupant's mother, and very serious injury to another child who had been nursed by her. The case occupant, sitting in a hook-over child seat alongside his mother, may have been shielded from serious injury by his mother's body. He sustained only a minor head laceration.

FATALITIES

While no fatality to any restrained child occurred within the time and geographic limits of IMPACT 3, Traffic Accident Research Unit teams have made a number of special studies of cases outside these limits and they have been reported¹⁰ by Henderson et al. along with some of the more serious IMPACT 3 cases. Vehicle intrusion or detachment of inadequately mounted restraints have been dominating factors in most of the few fatalities investigated to date.

SUMMARY

A. The IMPACT 3 project was a study of crashes involving children for whom some attempt at restraint had been made. Features of the 122 crashes were as follows:-

1. The study included crashes occurring within an area of approximately 80 km radius about the centre of Sydney. The crashes took place between January, 1974 and May, 1975.
2. The speed limit was 60 km/h or less at the scene of 106 (87%) of the crashes.
3. Collision forces were from the frontal direction in 56 (46%) of the crashes.

B Features of the 122 case vehicles were as follows:-

1. Vehicle damage intruded into the occupant compartment in 57 (47%) of the case vehicles.
2. The case vehicle overturned in 10 (8%) of the crashes.

C. Features of the 149 case occupants were as follows:-

1. The study included children aged under 8 years for whom attempts at restraint had been made. Uninjured children were included when notified.
2. The age of 87 (58%) of the case occupants was less than 3 years.
3. A rear seat was occupied by 100 (67%) of the case occupants.
4. A central seating position was occupied by 44 (30%) of the case occupants.
5. At least 17 case occupants ejected out of their restraint, or had their restraint detach from the case vehicle during their crashes. In 4 cases they ejected out of the case vehicle.
6. Amongst the case occupants were: 1 critically injured child (AIS of 5); 4 severely injured children (AIS of 3), and; 5 moderately injured children (AIS of 2).

7. Injuries to the head region dominated (9 out of 11) amongst the moderate or worse injury scores (AIS of 2 or more).
 8. In 14 cases of disconnection of a case occupant from attachment to the case vehicle, head injuries were recorded. Most of these cases involved escape from very loosely worn adult belts (6 case occupants), or disconnection of non-approved child seats (4 hook-under seats, 2 hook-over seats).
 9. Children who did not escape from attachment to their car and who suffered head injuries in side crashes were mostly occupying seats close to the crash side (11 case occupants) or centre seats (7 case occupants). Only 2 such case occupants sat away from the crash side.
 10. Children who did not escape from connection to their car and who suffered head injuries in frontal crashes mostly wore adult belts very loosely (9 case occupants).
- D. Features of the restraints used for the 149 case occupants were as follows:-
1. Most child restraints were not approved by the Standards Association of Australia to AS E46. Only 23 (37%) of the 62 child seats were approved, and only 8 (44%) of the 18 child harnesses were approved.
 2. Attempts had been made to tie down with extra straps (such as an adult seat belt) 7 (29%) of the 24 hook-under seats.
 3. Adult belts were generally adjusted very loosely.
 4. Adult belts were used much more often for older children than were child restraints, and were used as frequently by children aged 0 to 3 years as were child harnesses.
 5. A restraint usage transition point was found with all children aged under 6 months in baskets and all children aged 7 months or more in other kinds of restraint.
 6. Attempts had been made to tie down 9 (53%) of the 17 baskets.
 7. There were 3 cases of sharing of an adult belt. In one case an adult shared with a case occupant, the others involved pairs of case occupants. None of these occupants was injured.

E. Performance of child restraints approved to AS E46.

1. Case occupants using approved child restraints sustained head injuries less frequently than did occupants using non-approved child restraints and adult seat belts.
2. The approved child restraints were also indicated to be superior in comparisons of moderate injuries and worse, and comparisons of failures to confine occupants adequately during crashes.

CONCLUSIONS

Based upon the IMPACT 3 study, the limitations of which should be borne in mind, the following conclusions were reached:

1. Child seats and harnesses approved by the Standards Association of Australia for children aged 7 months or more give good crash protection when properly adjusted, and should be used by children in preference to belts supplied for adults and to unapproved child restraints.
2. Restrained bassinets appear to give moderate crash protection for children of suitable size, as indicated by the absence of moderate injury among all 17 such case occupants in the study.
3. Child restraints, other than restrained bassinets, should not be relied upon to give good crash protection unless approved to Australian Standards.
4. Whereas there is no objection to children wearing belts supplied for adults, it is of great importance that such belts should be pulled tight, to the limit of comfort. Ejection of a child from a loose seat belt is not improbable in a crash.
5. Even in approved child restraints, contact of the occupant's head with the car's interior may occur, hence attention should be given to reducing the excursion limits of AS E46 (as may possibly have been achieved in the newer AS 1754-1975), and to treating car interiors to render contact less hazardous.

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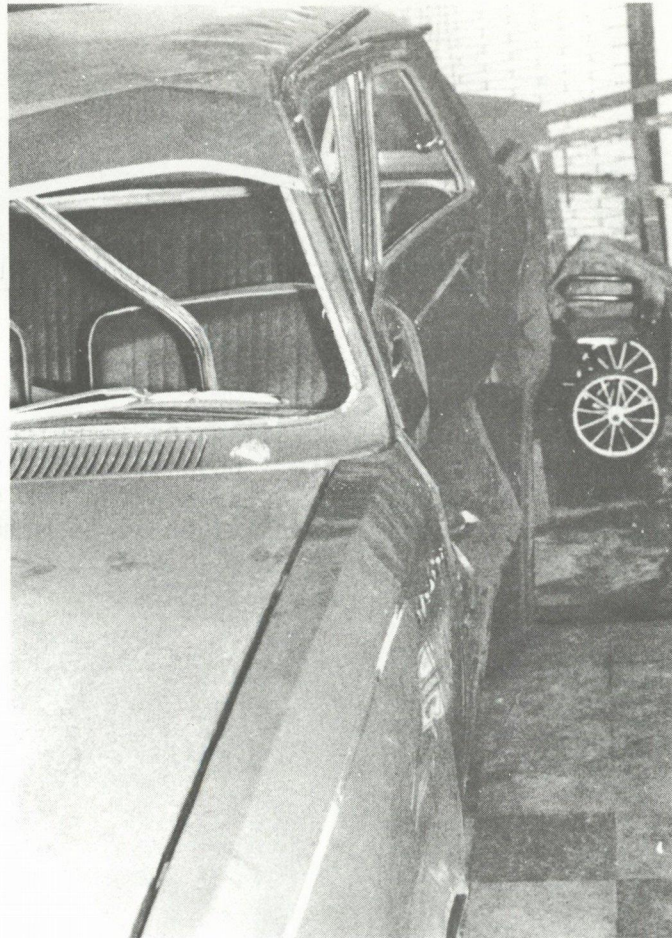
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APPENDIX A

DETAILS OF CASES YIELDING MODERATE INJURY OR WORSE

The following 10 summaries detail cases in which case occupants sustained an AIS score of 2 or more. Hospital reports were generally only obtained for case occupants. Details given for other occupants are therefore based upon descriptions given to team members by occupants.

DETAILS OF IMPACT 3 CASE NUMBER 27



Case vehicle 27 was a Vauxhall Viva 2-door sedan. It collided with a bus and rolled over. The vehicle damage was rated as 3, force direction was assessed as 9 o'clock.

Case occupant 27/1 was aged 1 year, 10 months and occupied the front left seat. She sat in hook-under child seat which was not SAA approved. She received AIS of 2 to the head region for multiple facial lacerations from broken side glass.

Other occupant: The driver wore a lap/sash belt and was uninjured.

SUMMARY OF IMPACT 3 CASE NUMBER 43



Case vehicle 43 was a Toyota Land Cruiser. It collided with a station wagon and then rolled over. Its roof completely detached. The vehicle damage was rated as 2, force direction was assessed as 9 o'clock.

Case occupant 43/1 was aged 7 years, 11 months and occupied the front left seat. She wore an adult lap belt which appeared to have been loosely adjusted. She ejected completely out of the vehicle, probably through the roof opening. A haematoma, abrasions and brief concussion led to an AIS rating of 2 to the head.

Other occupant: An unrestrained 6 year old child ejected out of the vehicle from the goods area. A fractured parietal bone (head) and clavicle (thorax) were sustained as well as some abrasions. The driver, wearing an adult lap/sash belt, received contusions.

SUMMARY OF IMPACT 3 CASE NUMBER 44



Case vehicle 44 was a Ford Cortina 2 door sedan. It collided with a telegraph pole. The vehicle damage was rated as 4, force direction was assessed as 12 O'clock.

Case occupant 44/1 was aged 1 year, 5 months and occupied the front left seat. She sat in a hook-over child seat. It was stated to have been tied down with the lap/sash belt fitted for front seat occupants. The child and/or seat struck the dashboard. The whereabouts of the child and seat immediately after the crash is not known. The child sustained a fractured base of the skull, facial lacerations and a haematoma which led to an AIS rating of 2.

Other occupant: The driver wore a lap/sash belt and sustained widespread injuries which led to inclusion in the IMPACT 2 study as a case occupant. An AIS of 2 was received to the head region, 4 to the thorax, 4 to the abdomen and 2 to the extremities. A 4 year old unrestrained child in the rear right seat sustained contusions.

SUMMARY OF IMPACT 3 CASE NUMBER 53



Case vehicle 53 was a Toyota Corolla 2 door sedan. It collided with a car and then rolled over. The vehicle damage was rated as 2, force direction was assessed as 9 o'clock.

Case occupant 53/1 was aged 7 years, 10 months and occupied the rear left seat. He wore a loosely adjusted lap/sash belt. A fractured mandible, probably from contact with intrusion, led to an AIS rating of 3 to the head region.

Other occupants: The driver wore a lap/sash belt and sustained a fractured arm. A 14 year old occupant wore a lap/sash belt, and was briefly concussed.

SUMMARY OF IMPACT 3 CASE NUMBER 67



Case vehicle 67 was a Ford Falcon 4 door sedan. It collided with a car. The vehicle damage was rated as 4; force direction was assessed as 9 0'clock.

Case occupant 67/1 was aged 3 years, 6 months and occupied the front centre seat. He sat in a hook-over child seat which was not tied down. The driver alleged that the child did not eject. He sustained a skull fracture and concussion which led to an AIS rating of 3 to the head region.

Other occupant: The driver wore a lap/sash belt and sustained contusions.

SUMMARY OF IMPACT 3 CASE NUMBER 69

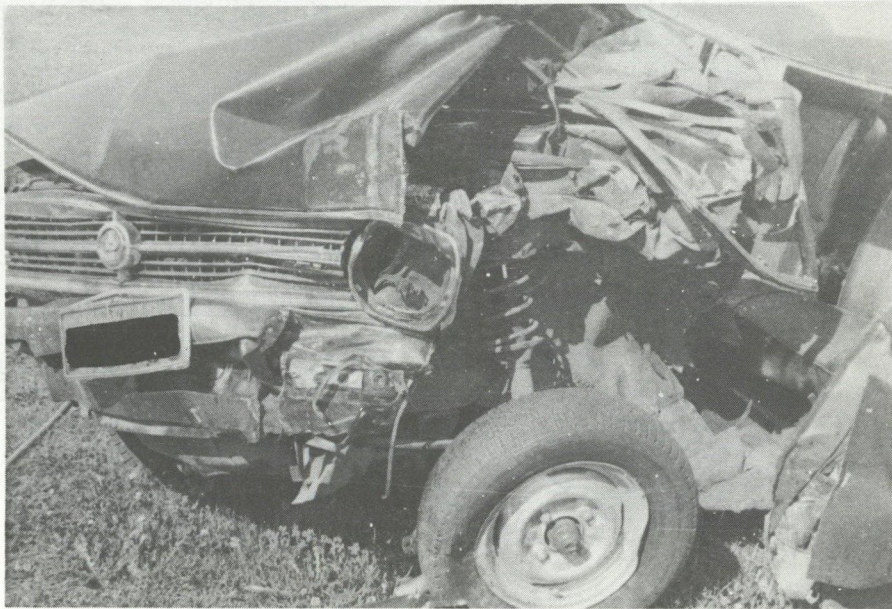


Case vehicle 69 was a Chrysler Valiant wagon. It collided on the left side with a car, and then collided front to front with an oncoming car. Vehicle damage was rated as 3, force direction 9 o'clock, for the side collision and as 5, force direction 12 o'clock for the frontal collision.

Case occupant 69/1 was aged 5 years, 6 months and occupied the front left seat. He wore a loosely adjusted sash belt. There was no lap strap. Multiple facial lacerations and contusions led to an AIS rating of 2 to the head region.

Other occupants: The driver wore a sash strap and received lacerations on leg, hand and face. The locks failed to hold the backrest of the rear seat from folding flat, and a baby in a bassinet in the goods area of the station wagon ejected out of the bassinet and struck the rear of the front seats. He sustained contusions to the head and shoulder.

SUMMARY OF IMPACT 3 CASE NUMBER 70



Case vehicle 70 was a Datsun 1200 4 door sedan. It collided with a utility pole. The vehicle damage was rated as 8, force direction was assessed as 12 o'clock.

Case occupant 70/1 was aged 6 years and occupied the front left seat. He wore a very loosely adjusted lap/sash belt, and was reached by intrusion of the car body. An AIS of 5 to the abdominal region followed a tearing of the undersurface of the liver and a haematoma in the duodenum. An AIS of 3 was received to the extremities region for a fractured femur and lacerated foot.

Other occupant: The driver wore a lap/sash belt, chipped his elbow and sustained contusions.

SUMMARY OF IMPACT 3 CASE NUMBER 71



Case vehicle 71 was a Volkswagen 1200 sedan which overturned. The vehicle damage was rated as 3, force direction was from roof towards floor.

Case occupant 71/1 was aged 5 years, 11 months and occupied the front left seat. His mother, who was driving, stated that he wore a loosely adjusted lap/sash belt. He ejected completely out of the car and sustained concussion, head lacerations and facial abrasions which led to an AIS of 3 to the head region. Abdominal abrasions were rated AIS of 0.

Other occupants: The driver wore a lap/sash belt and sustained a head laceration and various contusions.

SUMMARY OF IMPACT 3 CASE NUMBER 94



Case vehicle 94 was a Chrysler Valiant station wagon. It collided with a car. The vehicle damage was rated as 2, force direction was assessed as 12 o'clock.

Case occupant 94/1 was aged 2 years, 11 months and occupied the rear middle seating position. He was seated in a hook-over child seat which was not tied down. The child seat disconnected and finished with the child on the floor. A fractured skull and head laceration resulted in an AIS of 3.

Other occupants: The driver, wearing a lap/sash belt, was not injured. An unrestrained 7 year old child in the rear left seat sustained lacerations.

SUMMARY OF IMPACT 3 CASE NUMBER 118



Case vehicle 118 was a Morris Mini 2 door sedan. It collided with a station wagon. The vehicle damage was rated as 3, force direction was assessed as 11 o'clock.

Case occupant 118/1 was aged 5 years and occupied the front left seat. He wore a loosely adjusted lap/sash belt. He sustained concussion, and a laceration to the left ear. These led to an AIS of 2 to the head region.

Other occupant: The driver wore a lap/sash belt and sustained contusions.

APPENDIX B

DETAILS OF CASES INVOLVING LARGE VEHICLE DEFORMATION RATINGS

There were 4 case vehicles with deformation rated as 6, 7 or 8, indicating very extensive vehicle destruction. A further 10 case vehicles were rated as 5 for substantial vehicle deformation. Two of these 14 cases have already been described in Appendix A. (Cases 69 and 70). The other 12 are described in this Appendix.

SUMMARY OF IMPACT 3 CASE NUMBER 26



Case vehicle 26 was a Toyota Celica 2 door coupe. It collided with the front of a truck. Vehicle damage was rated as 5, force direction was assessed as 1 o'clock.

Case occupant 26/1 was aged 1 month and occupied the rear left seat. He lay in a bassinet with his head towards the car centre. The bassinet lay on the car seat and was allegedly held in position by the front left passenger seat being adjusted as far back as possible. He was not injured.

Other occupants: The driver wore a lap/sash belt and received extensive face, arm and knee lacerations. The front left passenger, an adult, wore a lap/sash belt and sustained extensive contusions to the chest and a leg.

SUMMARY OF IMPACT 3 CASE NUMBER 37



Case vehicle 37 was a Holden HD 4 door sedan. It collided with an electric power pole. The vehicle damage was rated as 7 and the force direction was assessed as 12 o'clock.

Case occupant 37/1 was aged 2 years and occupied the rear left seat. He wore a child harness which was not SAA approved and which had only one attachment to the car. He was not injured.

Case occupant 37/2 was aged 3 years, 11 months, and occupied the rear right seat. She wore a child harness which had not been approved by SAA. It consisted of a body harness connected to slide up or down a loop of webbing running up the backrest of the car seat. The child struck the rear of the front seat, and finished on the floor. The child's mother described contusions, however the hospital reported nil injury.

Other occupants: The driver wore a lap/sash belt and sustained a fractured vertebra, a fractured hand, and a contused abdomen. The front left passenger wore a lap/sash belt and sustained contusions.

SUMMARY OF IMPACT 3 CASE NUMBER 45



Case vehicle 45 was a Ford Falcon, 4 door sedan. It collided with a station wagon. The vehicle damage was rated as 5, force direction was assessed as 9 o'clock.

Case occupant 45/1 was aged 3 years and occupied the front centre seat. He sat in a hook-over child seat which was not tied down. The child seat apparently remained hooked over the rear seat. The front bar of the seat was alleged to have opened to leave the child caught by a plastic crotch strap. A small head laceration, not treated at hospital, was rated AIS of 1.

Other occupants: The 63 year old driver wore a lap/sash belt. He bruised his hip but was not admitted to hospital. The 22 year old front left passenger wore a lap/sash belt. She died in hospital from a crushed chest and ruptured spleen. A 6 weeks old baby, nursed by the deceased front left passenger, ejected completely out of the car. She sustained a fractured skull, and was still in hospital 1 month after the crash.

SUMMARY OF IMPACT 3 CASE NUMBER 86



Case vehicle 86 was a Datsun 240C 4 door sedan. It collided with a panel van. The vehicle damage was rated as 5, force direction was assessed as 12 o'clock.

Case occupant 86/1 was aged 1 year, 6 months and occupied the rear left seat. She wore a child harness which was not SAA approved. It consisted of a body harness connected to slide up or down a loop of webbing running up the backrest of the car seat. The child's mother reported contusions, the hospital reported nil injury.

Other occupants: The driver wore a lap/sash belt and sustained contusions.

SUMMARY OF IMPACT 3 CASE NUMBER 78



Case vehicle 78 was a Renault R 1330 station wagon. It collided with a car. The vehicle damage was rated as 5, force direction was assessed as 12 o'clock.

Case occupant 78/1 was aged 7 months and occupied the rear right seat. She sat in a bucket type child seat which was approved to AS E46. Her lap straps were much looser than her shoulder and crotch straps. A catch released in the folding rear backrest of the station wagon, apparently leading to the backrest loading the child seat. The bottom connecting strap tore out of the child seat, and the child sustained head and shoulder contusions both rated AIS of 1.

Case occupant 78/2 was aged 2 years, 4 months and she occupied the rear left seat. She wore a child harness which had approval to AS E46. The harness had a 40 mm wide lap strap. Contusions to the upper abdomen rated AIS of 1, probably arose from the lap strap, probably heavily loaded by movement of the car seat backrest.

Other occupants: The driver wore a lap/sash belt. Her seat broke free, probably partly due to forces transmitted by the case occupant 78/1, the seat belt broke, and widespread injuries resulted. She became a case of the IMPACT 2 study and sustained a head AIS of 2, thorax AIS of 4, abdomen AIS of 4, and an extremities AIS of 3.

SUMMARY OF IMPACT 3 CASE NUMBER 89



Case vehicle 89 was a Valiant Regal station wagon. It collided with a station wagon. The vehicle damage was rated as 5, force direction was assessed as 10 o'clock.

Case occupant 89/1 was aged 5 years and occupied the front left seat. He was lying down, head towards the car centre with lap/sash belt loosely around him. He remained on the seat, sustaining grazed knees, rated AIS of 0.

Case occupant 89/2 was aged 3 months and occupied the rear right seat. He was lying down in a basket, head towards the car centre. His mother alleged that there was only about 25 mm separating the basket and the front backrest, however this appears to have been an underestimate. The child remained in the basket and sustained no injury.

Other occupants: The driver wore a lap/sash belt, and received treatment for a lacerated knee and contusions. The unrestrained rear left passenger was treated for concussion and contusions.

SUMMARY OF IMPACT 3 CASE NUMBER 93



Case vehicle 93 was a Morris Major 4 door sedan. It collided with a car. The vehicle damage was rated as 5, force direction was assessed as 12 o'clock.

Case occupant 93/1 was aged 1 year, 2 months and occupied the rear left seat. He sat in a hook-under child seat which was not SAA approved, and which was not tied down. The child stayed in the child seat. It was not clear whether the child seat detached. Head contusions were rated AIS of 1.

Other occupants: The driver wore a lap/sash belt and was treated for a fractured nose and for knee contusions.

SUMMARY OF IMPACT 3 CASE NUMBER 107



Case vehicle 107 was a Volkswagen Passat 4 door sedan. It collided with a car and then with a utility pole. The vehicle damage was rated as 6, force direction was assessed as 12 o'clock.

Case occupant 107/1 was aged 2 years, 4 months, and occupied the rear centre seat. He sat in a bucket type child seat, approved to AS E46. He sustained minor shoulder abrasions, and contusions, but was not treated.

Other occupants: The driver wore a lap/sash belt and received treatment at hospital for soft tissue injuries to the chest and shoulder. An adult wearing a lap/sash belt in the front left seat received treatment for a head laceration and knee contusions. A 4 year old, unrestrained in the rear left seat, was treated for head and knee contusions.

SUMMARY OF IMPACT 3 CASE NUMBER 120

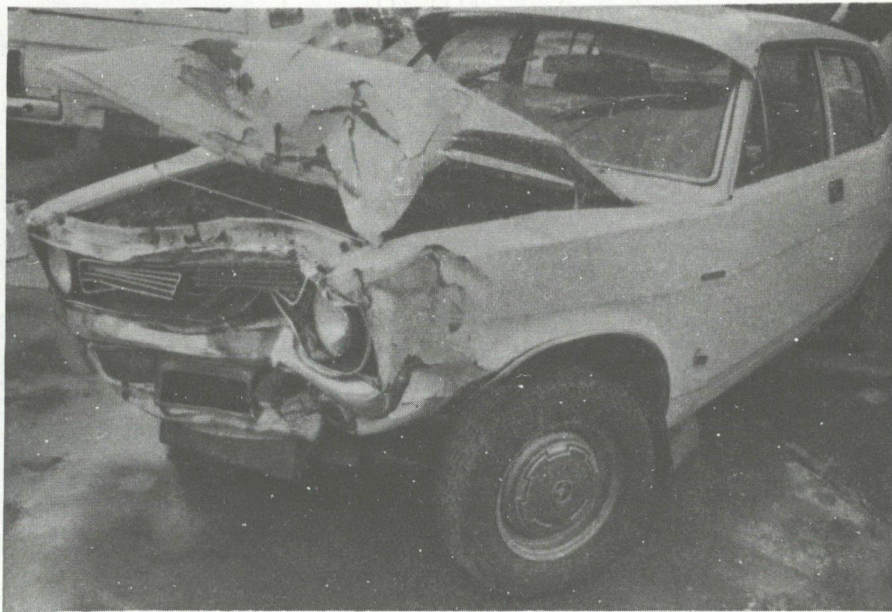


Case vehicle 120 was a Morris Mini K 1100 2 door sedan. It collided with a car. The vehicle damage was rated as 5, force direction was assessed as 12 o'clock.

Case occupant 120/1 was aged 1 year, 9 months and occupied the front left seat. He wore a very loosely adjusted lap/sash belt, and was found under the dashboard following the crash. A head laceration was rated AIS of 1.

Other occupants: The driver wore a lap/sash belt and was treated for a cartilage injury and for contusions.

SUMMARY OF IMPACT 3 CASE NUMBER 121

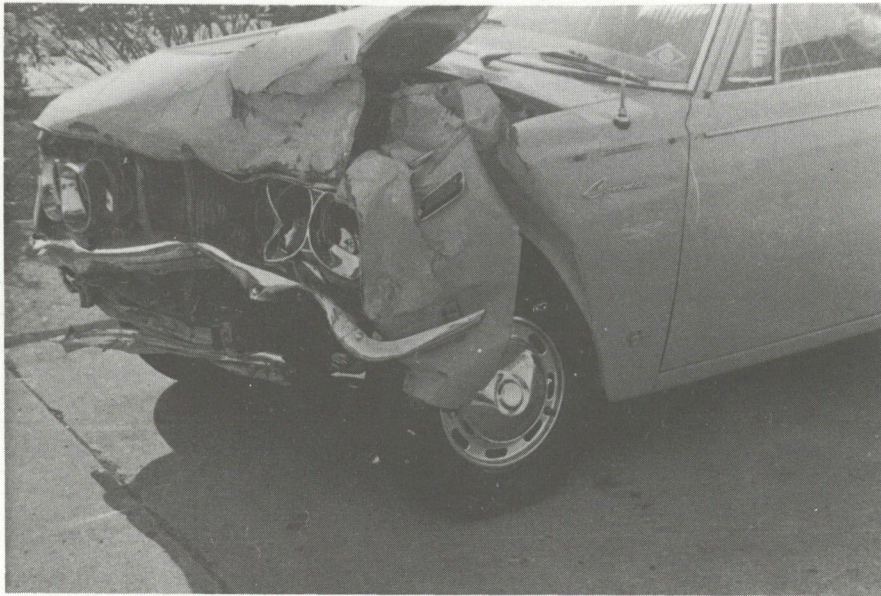


Case vehicle 121 was a Leyland Morris Marina 4 door sedan. It collided with a car. The vehicle damage was rated 5, force direction was assessed as 11 o'clock.

Case occupant 121/1 was aged 7 years and occupied the rear left seat. He wore an adult lap/sash belt which was adjusted very loosely. He sustained a head laceration which was rated AIS of 1.

Other occupants: The driver wore a lap/sash belt and received superficial abrasions. A 9 year old wore a lap/sash belt in the rear right seat and sustained a face laceration.

SUMMARY OF IMPACT 3 CASE NUMBER 125



Case vehicle 125 was a Toyota Corona 4 door sedan. It collided with a car. The vehicle damage was rated 6, force direction was assessed as 12 o'clock.

Case occupant 125/1 was aged 4 years, 9 months, and occupied the rear left seat. He wore a child harness which was SAA approved. Abrasions to both sides of his neck were rated AIS of 1.

Other occupant: The driver wore a lap/sash belt. He sustained a head laceration, rib and clavicle fractures, and abdominal contusions.

SUMMARY OF IMPACT 3 CASE NUMBER 126



Case vehicle 126 was a Chrysler Valiant Regal 4 door sedan. It spun into a utility pole. The vehicle damage was rated as 5, force direction was assessed as 6 o'clock.

Case occupant 126/1 was aged 4 years and occupied the front left seat. She wore a lap/sash belt and sustained no injuries.

Other occupants: The driver wore a lap/sash belt and sustained head laceration and contusions. An unrestrained adult on the rear left seat sustained face lacerations and rib fractures. An unrestrained adult on the rear right seat was briefly concussed.

APPENDIX C

GROUPS OF CHILD RESTRAINTS

The following pages describe the restraints encountered in IMPACT 3. Photographs and further descriptions may be found for some of the more common types in Reference 7. With the exception of the baskets, all restraints were arranged to face their passenger towards the front of the car.

1. BUCKET SEATS

The bucket seats incorporated a harness and a moulded plastic shell. The shell served as seat, backrest and headrest for the occupant, with the sides of the shell providing some lateral support. The harness typically comprised two shoulder straps and a lap strap with a central quick release buckle. Crotch straps were also fitted.

Crashes where children had been sitting in the child seat without the harness done up were excluded from the study as unrestrained. Cases where the crotch strap only was left undone were included.

The models included in the study were as follows:-

Safe-N-Sound KL	10
Safe-N-Sound X4	10
Safe-N-Sound Tri-Safe	1
Safe-N-Sound, old model	1
Britax B335	1
Steelcraft C57	1

Total 24 bucket seats

All but the old model Safe-N-Sound carried evidence of approval to AS E46.

2. HOOK-OVER SEATS

Hook-over seats comprise:-

- a. A metal frame, usually tubular, formed to hook-over the backrest of a car seat.
- b. Padded flat boards which serve as seat, backrest and, in many models, headrest.
- c. A harness or a hinged and padded rail passing in front of the child.

Some hook-over seats have both a harness and rail available for securing a child to the device. They were accepted into the study if either harness or rail was connected at the time of the crash.

No hook-over seat has been approved to AS E46. Many hook-over seats carry no printed indication of the manufacturer.

3. HOOK-UNDER SEATS

Hook-under seats comprise the padded boards and harness or rail of hook-over seats. They also have a tubular metal frame, but instead of being formed to hook over the backrest they are formed with protrusions intended to hook under the backrest.

As for hook-over seats, the devices were admitted into IMPACT 3 if front rail or harness was done up.

There is one hook-under seat which has been approved to AS E46 for use when tied down to the car, it does not have a rail this being specifically prohibited by E46 and 1754 as a rigid object, however it was not encountered in IMPACT 3. The hook-under seats frequently carried no printed indication of the manufacturer.

4. CHILD HARNESES APPROVED TO AS E46

Children's harnesses approved to Australian Standard E46 comprised two shoulder straps, a lap strap (sometimes being an adult lap belt) and a strap between the shoulder straps, running across the child's chest.

The models encountered in the study were as follows:-

Britax B336	4
Safe-N-Sound SS155	3
Safe-N-Sound SS150	1
<hr/>	
Total	8 approved harnesses

5. CHILD HARNESES, NOT APPROVED TO AS E46

The 10 non-approved harnesses generally carried no identification of the manufacturer.

In 4 cases they comprised a strap running from parcel shelf, down the front of the rear car seat backrest, to be anchored behind the car seat cushion. Sliding on this strap was a loop connected to a shoulder harness.

In 3 cases a shoulder-waist harness was tied to a single anchorage behind the car seat cushion.

There were 2 harnesses which had been made by parents from parts of seat belts and child harnesses. A further 1 harness, not seen on sale in Australia, had lap and shoulder straps and was anchored at 3 points.

6. BASKETS

The group of restraints referred to as baskets in this report comprised infant carry baskets or bassinets for which movement had been limited by location or tie down. The methods used to constrain the baskets or bassinets were as follows:-

On rear seat

Tied down with commercial bassinet restraint (Safe-N-Sound SS101)	3
Tied down with adult seat belts	
Two lap/sash straps looped around basket and tied to one another with cloth	1
Two lap/sash straps looped around basket but not tied.	1
One lap/sash strap looped around basket and connected to buckle	1
One lap/sash strap looped around basket and not connected	2
Not tied down	6
Front seat backrest adjusted against basket.	2
Other.	3
	5

In goods area of station wagon

Jammed longitudinally	1
Loose, against rear seat backrest	1
Loose, surrounded by goods	1
	3
	17

Some difficulty was experienced in deciding whether certain arrangements of baskets were, in fact, plausible attempts at restraint. Any claim to have attempted restraint of a basket led to the case being included into the study.

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7. ADULT BELTS

Three point lap/sash belts, as normally fitted in the outer seating positions of Australian cars, were worn by 37 case occupants.

Lap belts, as normally fitted in central seating positions of Australian cars, were worn by 13 case occupants.

Sash belts (without lap sections), running diagonally across the torso, and found in outer seating positions in some old Australian cars, were worn by 2 case occupants.