THE PARLIAMENT OF THE COMMONWEALTH
OF AUSTRALIA

MOTORCYCLE AND BICYCLE SAFETY

REPORT FROM THE HOUSE OF REPRESENTATIVES
STANDING COMMITTEE ON ROAD SAFETY

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- Mr P.W. Milne, B.Ec.(Hons)
- Dr M.R. Wigan, M.A, D. Phil.(Oxon), M. Inst.P., M.B.C.S., M.I.C.E., C. Eng.

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Chairman	The Hon. R.C. Katter, M.P.
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	Mr J.R. Short, M.P. (2)

Clerk to the Committee - Mr F.R. Hinkley

Advisers to the Committee
- Mr P.W. Milne, B.Ec.(Hons)
- Dr M.R. Wigan, M.A., D.Phil.(Oxon), M. Inst.P, M.B.C.S., M.I.C.E., C. Eng.

NOTES

(1) Mr Morris replaced Mr B. Cohen, M.P. as a Member of the Committee on 4 October 1977.

(2) Mr Groom replaced Mr J.R. Short, M.P. as a Member of the Committee on 2 June 1977.

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ACKNOWLEDGEMENT

Material used for illustrations in this report came from Dr M.R. Wigan; Australian Capital Territory Police and the Geelong Bikeplan Study Report. Use of this material is acknowledged with thanks.

REPORT FROM COMMITTEE

1. The Committee was appointed by resolution of the House of Representatives on 2 March 1978 to inquire and report on -

(a) the main causes of the present high level of the road toll in Australia;

(b) the most effective means of achieving greater road safety in Australia;

(c) the particular aspects of the problem to which those concerned with road safety could most advantageously direct their efforts, and

(d) the economic cost to the community of road accidents in Australia in terms of -

(i) material damage,

(ii) loss of man-hours and earning capacity, and

(iii) cost of treatment of accident victims.

2. These terms of reference are identical with those of the Standing Committee on Road Safety established in the Twenty-ninth and Thirtieth Parliaments and with the terms of reference of the Select Committees on Road Safety in the Twenty-seventh and Twenty-eighth Parliaments.

3. The purpose of this report is to place before the House the results of the inquiry into motorcycle and bicycle safety. A substantial part of the work associated with this inquiry was undertaken by the former Committee. The dissolution of Parliament on 10 November 1977 prevented the previous Committee from taking final evidence on the inquiry in Adelaide and Perth and considering a draft report.

4. Further evidence was taken by the Committee on this inquiry in Adelaide and Perth on 26-27 April 1978.

5. The Committee has decided that the results of the

inquiry should not be delayed. In view of the importance of the inquiry the Committee considers that it has a duty to report to the House without further delay in order that recommendations and conclusions may be known and put into effect.

6. The Committee therefore appointed a Sub-committee consisting of three Committee members who were members of the previous Committee to consider the draft report.

7. The Sub-committee's report has been adopted by the Committee as the report on Motorcycle and Bicycle Safety.

8. In adopting the Sub-committee report the Committee points out that the report does not necessarily convey specific views of Committee members not being members of the Sub-committee.

9. The Committee would like to express its appreciation to members of the previous Committee for their contributions; to Mr P.W. Milne, Commonwealth Department of Transport, and Dr M.R. Wigan, Australian Road Research Board, who provided valuable assistance as specialist advisers throughout the inquiry to this Committee and the previous Committee; to those who made submissions during the inquiry; and to those who assisted in the preparation and compilation of the report.

10. The report of the Sub-committee follows.

May 1978

R.C. Katter
Chairman

MOTORCYCLE AND BICYCLE SAFETY

SUB-COMMITTEE REPORT TO

THE HOUSE OF REPRESENTATIVES

STANDING COMMITTEE ON

ROAD SAFETY

MEMBERSHIP OF THE SUB-COMMITTEE

Chairman	..	The Hon. R.C. Katter, M.P.
Members	..	The Hon. C.K. Jones, M.P.
		Mr B.J. Goodluck, M.P.

Clerk to the Sub-committee - Mr F.R. Hinkley

RECOMMENDATIONS

The Committee recommends that:

THE NATURE AND MAGNITUDE OF THE PROBLEM

Availability of Accident Data

. *States and Territories amend their road accident report forms to include the list of common items recently endorsed by the Australian Transport Advisory Council.* (Paragraph 55)

MOTORCYCLE SAFETY

Introduction

. *differing safety requirements for those motorcycles used both on and off the road be given due consideration by authorities proposing safety requirements for this class of motorcycle.* (Paragraph 60)

. *the Advisory Committee on Safety in Vehicle Design keep under review the need to take up relevant overseas design requirements for motorcycles.* (Paragraph 62)

Motor Primary Safety

- Braking

. *a requirement for licensing be a demonstration of the effective use of all brakes fitted to the motorcycle particularly the front brakes,*

and

. *the Commonwealth Department of Transport develop advisory performance specifications for this test.* (Paragraph 68)

. *positive steps be taken to appraise developmental anti-lock motorcycle braking systems by experiment within Australia.* (Paragraph 69)

. *experiments be undertaken to assess the physical performance of, and the ability of riders to make better practical use of, coupled braking systems as exemplified by Moto Guzzi with a view to encouraging wide use of this type of system if shown to demonstrate an added margin of safety.* (Paragraph 70)

. *Australian Design Rule 33, Motorcycle Brake Systems, be reviewed to ensure that proof of compliance requirements are brought within the capacity of the Australian motorcycle industry.* (Paragraph 72)

. *motorcycles utilising automatic clutches and automatic transmissions without a separate device for engine disengagement should be taken into account in the revision of Australian Design Rule 33.* (Paragraph 73)

- Steering and Handling

. *motorcycle manufacturers provide as original equipment optional fairings and luggage carrying equipment endorsed as suitable to the Australian market;*

. *the Advisory Committees on Safety in Vehicle Design and Vehicle Performance draft regulations restricting fitment to motorcycles of accessories likely to produce problems in vehicle stability;*

and

. *the Publicity Advisory Committee on Education in Road Safety in consulting with motorcycle user groups consider the need for assembling and publicising consumer information with regard to the fitment of accessories likely to introduce stability problems to motorcycles.* (Paragraph 80)

. *a literature and research review of existing and potential problems relating to motorcycle stability and handling be undertaken by the Advisory Committee on Safety in Vehicle Design.* (Paragraph 81)

- Tyres and Wheels

. *the Publicity Advisory Committee on Education in Road Safety collate and publicise information on the matching of motorcycle tyres to specific machines.* (Paragraph 89)

. *the Advisory Committee on Safety in Vehicle Design draft design rules on motorcycle tyres, wheels and rims;*

and

. *the Advisory Committee on Vehicle Performance prepare Draft Regulations on motorcycle wheels and rims.* (Paragraph 91)

- Layout of Controls and Displays

. *the States and Territories consider adopting Section 18 of the Draft Regulations.* (Paragraph 93)

- Visibility and Lighting

. *the Advisory Committee on Safety in Vehicle Design urgently introduce a design rule requiring a motorcycle's headlamp to be on when the ignition switch is on;*

and

. *the Advisory Committee on Road User Performance and Traffic Codes include a requirement in the National Road Traffic Code for mandatory headlamp usage.* (Paragraph 107)

. *the Commonwealth Department of Transport undertake an assessment of the benefits of combining or extending aids to increase the conspicuity of motorcycles and riders and that these devices be tested in field trials involving actual riding conditions.* (Paragraph 113)

. *the Advisory Committee on Safety in Vehicle Design investigate the effect of car blind spots and the use or omission of near-side car mirrors on motorcycle and bicycle visibility, with a view to amending Australian Design Rule 14, Rear Vision Mirrors.* (Paragraph 114)

. *the Draft Regulation covering the use of flat mirrors for rearward vision be reviewed by the Advisory Committee on Vehicle Performance to permit the use of convex mirrors;*

and

. *in view of the firm convictions of riders favouring headlamp usage and convex mirrors, rider representatives be invited to participate in the deliberations of the Advisory Committees on Safety in Vehicle Design, on Vehicle Performance and on Road User Performance and Traffic Codes.* (Paragraph 115)

- In Use Aspects

. *compulsory motorcycle inspection be required prior to re-registration or transfer of ownership.* (Paragraph 120)

Rider Primary Safety

- Rider Training

. *the Commonwealth Department of Transport sponsor and assist in the development and subsequent evaluation of pilot rider training and testing programs.* (Paragraph 126)

- Licensing

. *model testing procedures and standards for rider and driver licence applicants be developed by the Commonwealth Department of Transport.* (Paragraph 131)

- Publicity

. *the Publicity Advisory Committee on Education in Road Safety develop and evaluate a range of publicity campaigns relating to motorcycle safety;*

and

. *consideration be given to including rider representation in the development of the publicity campaign.* (Paragraph 138)

- Rider and Driver Vision

. *the Commonwealth Department of Business and Consumer Affairs and relevant State authorities give consideration to requiring that eye protection equipment sold to riders comply with the requirements of Australian Standard 1609, Automotive Eye Protection.* (Paragraph 151)

. *the Standards Association of Australia give consideration to the inclusion of anti-scratching requirements within Australian Standard 1609, Automotive Eye Protection.* (Paragraph 152)

. *as visors are often manufactured from polycarbonate the Standards Association of Australia include in Australian Standard 1609 a requirement for an informative brochure or label to be provided specifying safe cleaning materials and containing a warning on deleterious effects of hydrocarbons.* (Paragraph 153)

- Actions of Other Road Users

. *relevant State authorities re-examine the need to retain differential speed restrictions on motorcycle riders with pillion passengers in view of the alleged additional risks involved when such vehicles are restricted to a lower speed than other traffic.* (Paragraph 155)

Road and Environmental Aspects

. *the National Association of Australian State Road Authorities sponsor further research to:*
   (a) determine safe road marking materials,
   (b) assess the importance of the road surface to the motorcycle, and
   (c) reduce the 'slip' factor of certain road surfaces.
   (Paragraph 161)

. *road planning and construction authorities consider the differing safety requirements of motorcycles and other motor vehicles in future road construction and placement of road furniture.* (Paragraph 164)

Rider Secondary Safety

- Helmets

. *the Standards Association of Australia helmet committee review Australian Standard 1698, Protective Helmets for Vehicle Users, as soon as possible and that the review process seek to include the views of user, importing and manufacturing groups.* (Paragraph 175)

. *the Minister for Business and Consumer Affairs allow import entry to protective helmets particularly suited to speciality uses.* (Paragraph 180)

. *the Standards Association of Australia consider the need for separate standards on protective helmets suitable for use in an appropriate range of uses. Alternatively, the same purpose could be achieved by defining appropriate helmet categories, with appropriate testing requirements within an updated Australian Standard 1698.* (Paragraph 181)

. *Customs Regulations be appropriately amended to allow import entry of helmets to be tested for compliance to Australian Standard 1698.* (Paragraph 182)

. *the Advisory Committee on Road User Performance and Traffic Codes examine appropriate solutions to the problem of helmet sales which comply to superseded helmet standards or for which approval to Australian Standard 1698 has been withdrawn subsequent to marking.* (Paragraph 184)

. *the Commonwealth Department of Transport introduce a system of post-accident analysis of motorcyclists' helmets;*

and

. *compliance to Australian Standard 1698 of helmets available in the marketplace be monitored by a government sponsored independent testing agency and that the results be widely disseminated.* (Paragraph 185)

. *responsible organisations support Dr Yeo's proposals for collection of relevant information from spinal units throughout Australia and for a joint study by the Traffic Accident Research Unit in New South Wales and Dr Yeo into the relationship of helmet type and spinal cord injury.* (Paragraph 189)

BICYCLE SAFETY

Bicycle Primary Safety

- Bicycle Design and Standards

. *consideration be given to requiring imported bicycles to meet the requirements of Australian Standard 1927, Pedal Bicycles, as revised, and to having compliance to the standard required under Section 62 of the Trade Practices Act.* (Paragraph 221)

. *the Standards Association of Australia give serious consideration to amending Australian Standard 1927 to require two braking systems on bicycles and to provide for appropriate levels of wet weather braking performance.* (Paragraph 224)

. *the Standards Association of Australia immediately review Australian Standard 1927 with a view to including requirements to control unsafe features of Dragster or Hi Rise handlebar bicycles.* (Paragraph 226)

- Bicycle Visibility

(a) Lights

. *the Standards Association of Australia prepare an appropriate Australian Standard for bicycle lighting.* (Paragraph 230)

(c) Reflectorised Tyres

. *cyclists should be made aware of the benefits of reflectorised tyres so that they can make their own assessment on their merits as an additional item of safety equipment.* (Paragraph 238)

- Bicycle Registration

. *a study be undertaken by the Commonwealth Department of Transport to assess the advantages and disadvantages of compulsory registration of bicycles in Australia.* (Paragraph 247)

- In Use Aspects

. *the benefits of roadworthiness checks on bicycles be also considered in the study on compulsory bicycle registration recommended by the Committee.* (Paragraph 250)

Cyclist Primary Safety

- Cyclist Training

. *further research be undertaken examining the feasibility of developing a training curriculum suitable for use as a cyclist training guide throughout Australia.* (Paragraph 255)

- Legislation and Enforcement

. *stricter enforcement of road rules applying to cyclists be implemented.* (Paragraph 258)

- Rider Licensing

. *consideration be given to whether registration procedures should include tests for cyclist competency and licensing in the study recommended by the Committee on compulsory bicycle registration.* (Paragraph 264)

- Publicity

. *the Publicity Advisory Committee on Education and Road Safety consider the need for appropriate publicity campaigns on bicycle safety.* (Paragraph 268)

Road and Environment Factors

. *the safety value of the various types of bicycle ways including the use of footpaths be investigated under Australian conditions by the Commonwealth Department of Transport.* (Paragraph 275)

Cyclist Secondary Safety

. *cyclists be advised of the safety benefits of protective helmets by publicity or other suitable means;*

and

. *the possibility of requiring cyclists to wear helmets be kept under review.* (Paragraph 289)

MOPEDS

. *the minimum age for granting a licence for moped riding be one year less than that for a motorcycle licence.* (Paragraph 306)

. *the requirement that moped riders wear crash helmets should be retained.* (Paragraph 310)

ABBREVIATIONS

ABS	Australian Bureau of Statistics
ACCA	Auto Cycle Council of Australia
ACSVD	Advisory Committee on Safety in Vehicle Design
ACVP	Advisory Committee on Vehicle Performance
ADR	Australian Design Rule
AMVCB	Australian Motor Vehicle Certification Board
ARRB	Australian Road Research Board
AS	Australian Standard
ATAC	Australian Transport Advisory Council
BAL	Blood Alcohol Level
COMVE	Committee on Motor Vehicle Emission
CPSC	Consumer Product Safety Commission (USA)
ECE	Economic Community of Europe
EPA	Environmental Protection Authority
FMVSS	Federal Motor Vehicle Safety Standard (USA)
ISO	International Standards Organisation
MIRA	Motor Industries Research Association (UK)
PACERS	Publicity Advisory Committee on Education in Road Safety
SAA	Standards Association of Australia
TARU	Traffic Accident Research Unit

CHAPTER 1

INTRODUCTION

The Reference

1. The House of Representatives Standing Committee on Road Safety was appointed by resolution of the House of Representatives on 2 March 1978 to inquire into and report on:

(a) the main causes of the present high level of the road toll in Australia;

(b) the most effective means of achieving greater road safety in Australia;

(c) the particular aspects of the problem to which those concerned with road safety could most advantageously direct their efforts; and

(d) the economic cost to the community of road accidents in Australia in terms of -

(i) material damage;

(ii) loss of man hours and earning capacity; and

(iii) cost of treatment of accident victims.

2. These terms of reference are identical with those of the Standing Committee on Road Safety established in the Twenty-ninth and Thirtieth Parliaments and with the terms of reference of the Select Committees on Road Safety in the Twenty-seventh and Twenty-eighth Parliaments.

3. In July 1974 the Committee of the Twenty-ninth Parliament began an inquiry into safety aspects of vehicles using public roads, but due to the complexity and size of the subject, it subsequently decided to restrict its investigations to matters concerning passenger motor vehicle safety. The Committee's report entitled *Passenger Motor Vehicle Safety* was tabled in the House of Representatives on 2 June 1976. On 5 May 1976 the Committee resolved that it inquire into a further section of the original vehicle inquiry, namely heavy vehicles,

or more specifically, trucks and buses. This report entitled *Heavy Vehicle Safety* was tabled in the House of Representatives on 31 May 1977. The Committee resolved to inquire into the final section of the original vehicle inquiry, namely motorcycles and bicycles, on 19 August 1976.

The Inquiry

4. On 11 September 1976 the Committee placed advertisements in major metropolitan newspapers inviting interested individuals and organisations to make submissions on the motorcycle and bicycle aspects of road safety. In addition manufacturers, importers, assemblers, Commonwealth and State road safety and regulatory authorities, research bodies, clubs and associations, and numerous other organisations were approached directly and invited to make submissions.

5. One hundred and eighty-one submissions were received and 112 witnesses appeared before the Committee. A list of witnesses who appeared before the Committee is given at Appendix 1.

6. Commencing on 31 May 1977 one in camera and 11 public hearings were held at which 2244 pages of evidence and many Exhibits were taken. A list of Exhibits is given at Appendix 2. Evidence given at public hearings is available for inspection in Hansard form at the Committee Office of the House of Representatives and the National Library of Australia in Canberra.

7. A number of inspections were undertaken in this Inquiry. In June 1977 the Committee inspected the children's Traffic Demonstration Centre in the Australian Capital Territory; attended in July 1977 a night-time demonstration of reflective tyres and helmets in Sydney; was represented in September 1977 at the Geelong Bikeplan Seminar and inspected the Spinal Unit of the Royal North Shore Hospital in Sydney in October 1977. In April 1978 the Committee inspected motorcycle and bicycle

training at the Road Safety Instruction Centre in Adelaide; mopeds and motorcycle and bicycle training at the National Safety Council's Safety Instructional Centre in Perth and the Crestwood Estate in Perth.

8. This Inquiry into the safety of motorcycles and bicycles is one of a number of inquiries the Committee has conducted into aspects of the road safety problem. In previous reports the Committee has directed its attention to the need for a national authority on road safety and standards, to statistical and data collection needs, to the roads and their environment and, as previously mentioned, to passenger motor vehicle and heavy vehicle safety. As to the human aspect, another vital area of road safety, the Committee has begun to formulate inquiries into this very important area.

9. The Committee concentrated its attention in this Inquiry on endeavouring to determine the extent and nature of the problems relating to motorcycle and bicycle safety and on measures by which the safety of these vehicles could be improved. The evidence received indicated that there are many view points from which to assess the problems and in a number of cases solutions are not readily apparent.

CHAPTER 2

THE NATURE AND MAGNITUDE OF THE PROBLEM

General

10. Motorcycles and bicycles have become increasingly popular since 1966. Available statistics indicate that there has been a dramatic increase in their numbers in the period. In comparison with other road vehicles two wheeled vehicles use less road space, achieve considerable fuel savings and therefore less atmospheric pollution. Along with pedestrians, however, motorcycle riders and cyclists are the most vulnerable of all road users because of their high susceptibility to injury should a collision occur. In 1976, motorcyclist and cyclist casualties constituted 15% of total road accident casualties in Australia. However, the accident characteristics of the two groups are quite different.

Motorcycles

- Manufacturers and Importers

11. No manufacturing of motorcycles is at present carried out in Australia and none of the major overseas manufacturers presently have assembly plants in Australia. Local representatives of these overseas manufacturers act solely as importers and/or distributors. They do not have research facilities or extensive statistical capability for accident and safety analysis. However, they have been active in important safety related areas such as formulation of design rules for motorcycles, rider training schemes and safety education campaigns.

12. The Japanese motorcycle manufacturers, Honda, Yamaha, Suzuki and Kawasaki, hold more than 90% of the Australian market compared with their share of 60-70% of the world market.[1] Approximately 48 makes of motorcycles share the remaining segment of the Australian market

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1 Evidence, pp. 160, 689.

Typically most of these provide a range of motorcycle models designed to meet various uses. Both Honda and Yamaha have approximately 30 models each.[1]

13. It is evident from Table 1, which shows all makes of motorcycles exported from Japan to Australia, that not all motorcycles bought are registered for use on the road. Those not registered are used for recreational, agricultural and competitive purposes.

14. Figures 1 and 2 show the trends in numbers of vehicle registrations and numbers of new vehicle registrations. From Figure 1 it can be seen that the number of registered motorcycles has risen rapidly from 69,000 in 1966 to 291,600 in 1976 (see Appendix 3). From Figure 2 it can be seen that registrations of new motorcycles increased dramatically from 9,738 in 1966 to 80,538 in 1974. New motorcycle registrations following 1974 have declined substantially. For the 12 months ended December 1977 new registrations stood at 41,371. The Committee was told that one explanation for the decline in motorcycle sales is the high unemployment amongst the age group that buys the majority of motorcycles.

- Accident Involvement

15. A motorcycle offers little protection to the rider in the event of a collision. In a crash situation the rider frequently makes direct physical contact with the other vehicle and almost always with the road surface. Statistics indicate that in comparison with an occupant of a car or station wagon the rider of a motorcycle is up to 16 times more likely to become a road accident casualty (see Table 2).

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1 Evidence, p. 934.

TABLE 1

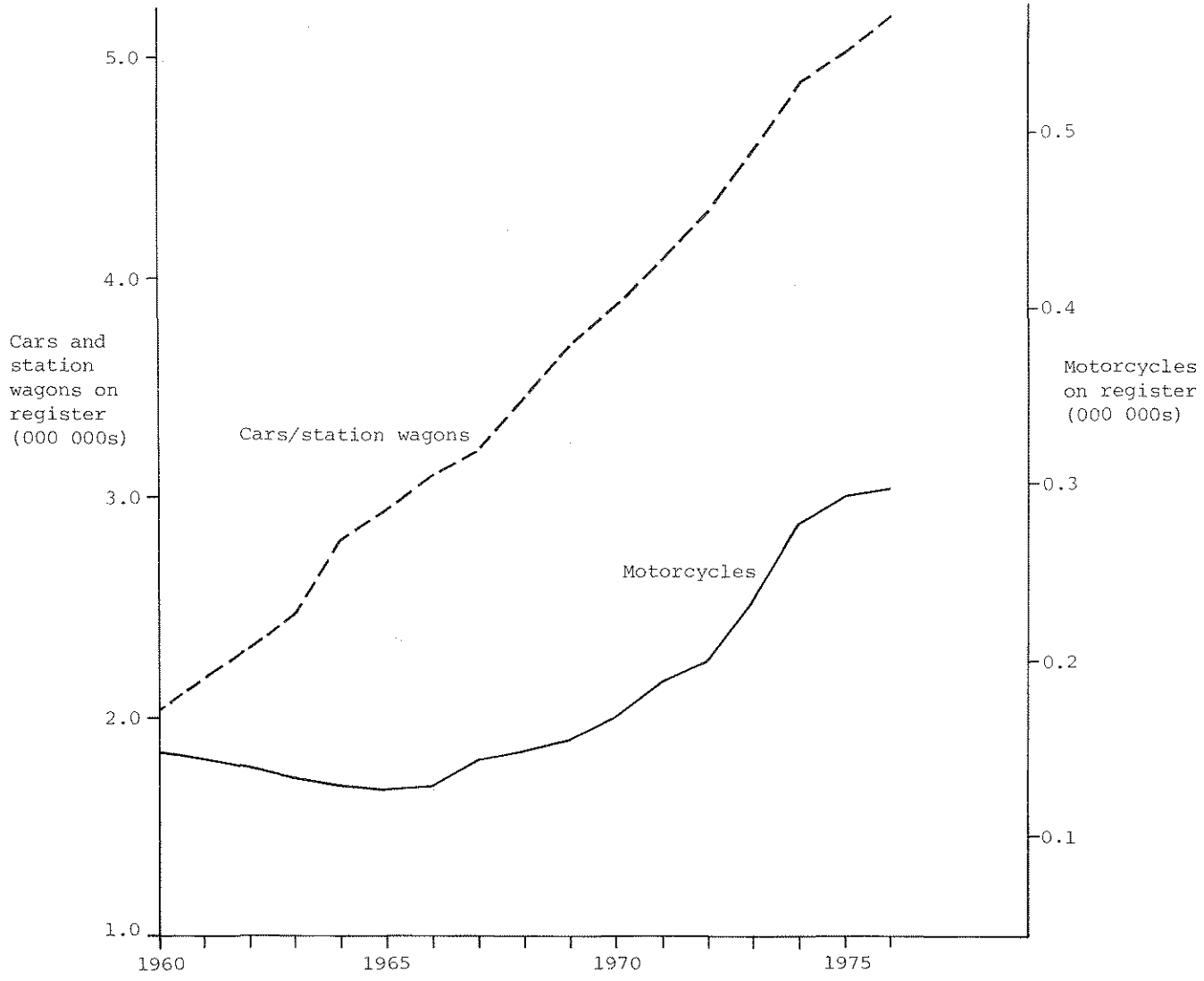
ALL MAKES OF MOTORCYCLES EXPORTED
FROM JAPAN TO AUSTRALIA
DECEMBER 1975 - NOVEMBER 1977

Engine Capacity cc	Number	Per Cent	Uses
0 - 50	2257	2.73%	Motor cycles with engine capacities below 90 cc are, in the majority, mini bikes used in the off-road areas and do not come into the registration figures.
51 - 90	16899	20.46%	
91 - 125	18461	22.35%	A high percentage of machines in the 90-125 cc class are agricultural and competition types that are not included in registration figures.
126 - 250	22835	27.64%	Machines in this class are generally used for commuting with a high number of off-road and competition types involved.
251 - 450	8842	10.70%	Used both for commuting and pleasure.
Over 450	13312	16.11%	Mainly used for pleasure.
Over 251	22154	26.81%	Machines over 251 cc capacity account for a quarter of all machines sold and for half of registerable road motorcycles.
Over 126	44989	54.46%	Machines over 126 cc capacity account for over half of all machines imported into Australia from Japan.
TOTAL	82606		

Source: Evidence, p. 86.

FIGURE 1

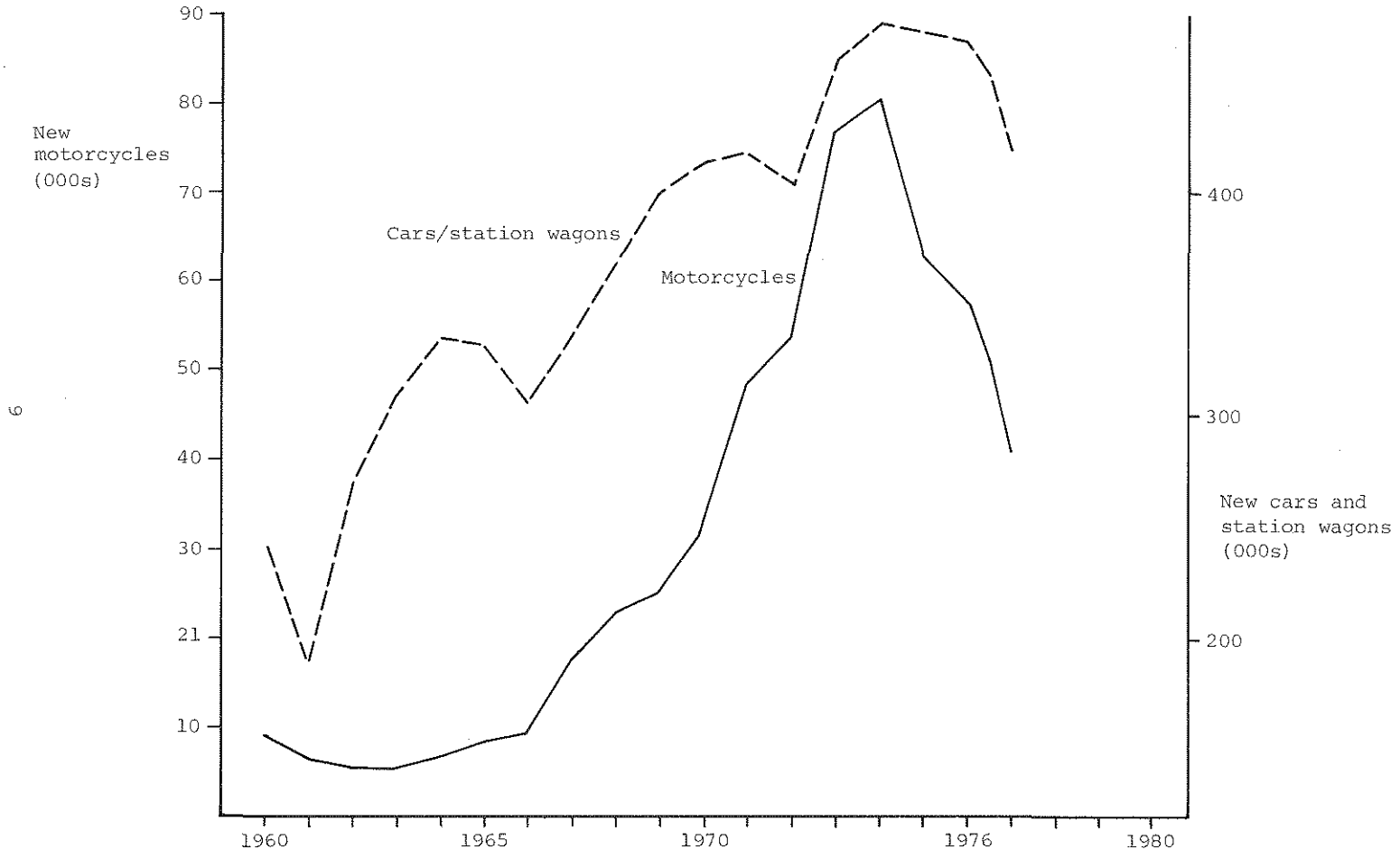
TOTAL VEHICLES ON REGISTER - MOTORCYCLES AND CARS/STATION WAGONS



Source: ABS Motor Vehicle Registration Statistics.

FIGURE 2

NUMBERS OF NEW VEHICLES REGISTERED - MOTORCYCLES AND CARS/STATION WAGONS



Source: ABS Motor Vehicle Registration Statistics.

TABLE 2

RELATIVE HAZARD OF MOTORCYCLE TRAVEL COMPARED WITH OTHER FORMS OF ROAD TRANSPORT, VICTORIA, 1971

	MOTOR CYCLES	CARS AND STATION WAGONS	LIGHT COMMERCIAL	TRUCKS	BUSES	TOTAL
Number on register[1]	28,160	1,131,361	136,303	92,323	5,129	1,393,276
Vehicle kilometres (million)[2]	185.8	18,649.3	2,086.7	1,862.9	132.7	23,062.3
Occupant kilometres (million)[3]	192	36,225	2,737	2,254	1,327	42,734
Involvement in casualty accidents[4]	1,333	18,794	1,650	1,246	94	23,117
Occupant casualties[5]	1,350	15,626	1,219	315	90	18,600
Accidents per '000 vehicles	47.34	16.61	12.11	13.50	18.32	16.59
Accidents per million vehicle km's	7.17	1.00	0.79	0.67	0.71	1.00
Accidents per million occupant km's	6.96	0.52	0.60	0.55	0.07	0.54
Casualties per '000 vehicles	47.94	13.81	8.94	3.41	17.55	13.35
Casualties per million vehicle km's	7.27	0.84	0.58	0.17	0.68	0.81
Casualties per million occupant km's	7.04	0.43	0.45	0.14	0.07	0.43

SOURCE NOTES

1 As at 30 September 1971 - ABS 1971 Motor Vehicle Census.

2 . For all vehicles except buses, year ending 30 September 1971 - Unpublished data from ABS 1971 Survey of Motor Vehicle Usage.

NOTE: Mileage data refer to mileage by Victorian registered vehicles.

. For buses, year ending 30 June 1971 - ABS 1971 Bus Fleet Operations Survey.

NOTE: Bus mileage data refer to all bus mileage within Victoria.

It is understood that this figure is very similar to the mileage of Victorian registered buses.

3 . For all vehicles except buses, year ending 30 September 1971 - ABS 1971 Survey of Motor Vehicle Usage.

. For buses, year ending 30 June 1971. Estimated on basis of average bus occupancy per bus mile of 10, which is the average occupancy rate of buses involved in accidents in Victoria in 1971-1973.

4 & 5 Year ending 31 December 1971 - Road Traffic Accidents Involving Casualties, 1971 - ABS Victorian Office.

Source: I.R. Johnston, P.W. Milne and M.H. Cameron, 'Age, Experience and Motorcycle Engine Capacity in Motorcycle Accidents' in *Motorcycles and Safety Symposium*, Australian Road Research Board and Commonwealth Department of Transport, Melbourne, June 18, 1976, p. 12.

16. In view of the high level of vulnerability of riders to injury and statistics indicating a high motorcycle accident involvement rate, the Committee has considered in some detail available information relating to motorcycle accident characteristics. The Committee considers that an understanding of accidents, their basic characteristics and causes is essential to determining those measures which should be introduced to reduce accidents, injuries and fatalities involving motorcycles.

17. Motorcyclist casualties have risen at a rate unmatched by any other category of road user in recent years. This trend is shown in Figure 3 together with motorcycle registrations for the period 1966-1976. While the absolute number of casualties rose dramatically over this period it should be noted that a comparison of casualties per 10,000 registered motorcycles reveals a decline from 434.5 to 376.3, a decrease of 13%. Motorcycle accident involvement over this period when compared on this basis indicates that the increase in casualties has been a function of the boom in motorcycle popularity.

18. In terms of numbers of vehicles registered, Table 2 indicates that the involvement rate of motorcycles in casualties and accidents is higher than for any other major class of road vehicle. When allowance is made for relative exposure[1] to accidents, in terms of kilometres travelled, as in Table 2, the high relative risk of motorcycle travel in comparison with other forms of road transport becomes even more apparent. From Table 2 it can be seen that, on a distance travelled basis, a motorcycle is 7.17 times more likely to be involved in an accident than a car or station wagon and the rider is 16 times more likely to become a road accident casualty than occupants of a car or station wagon.

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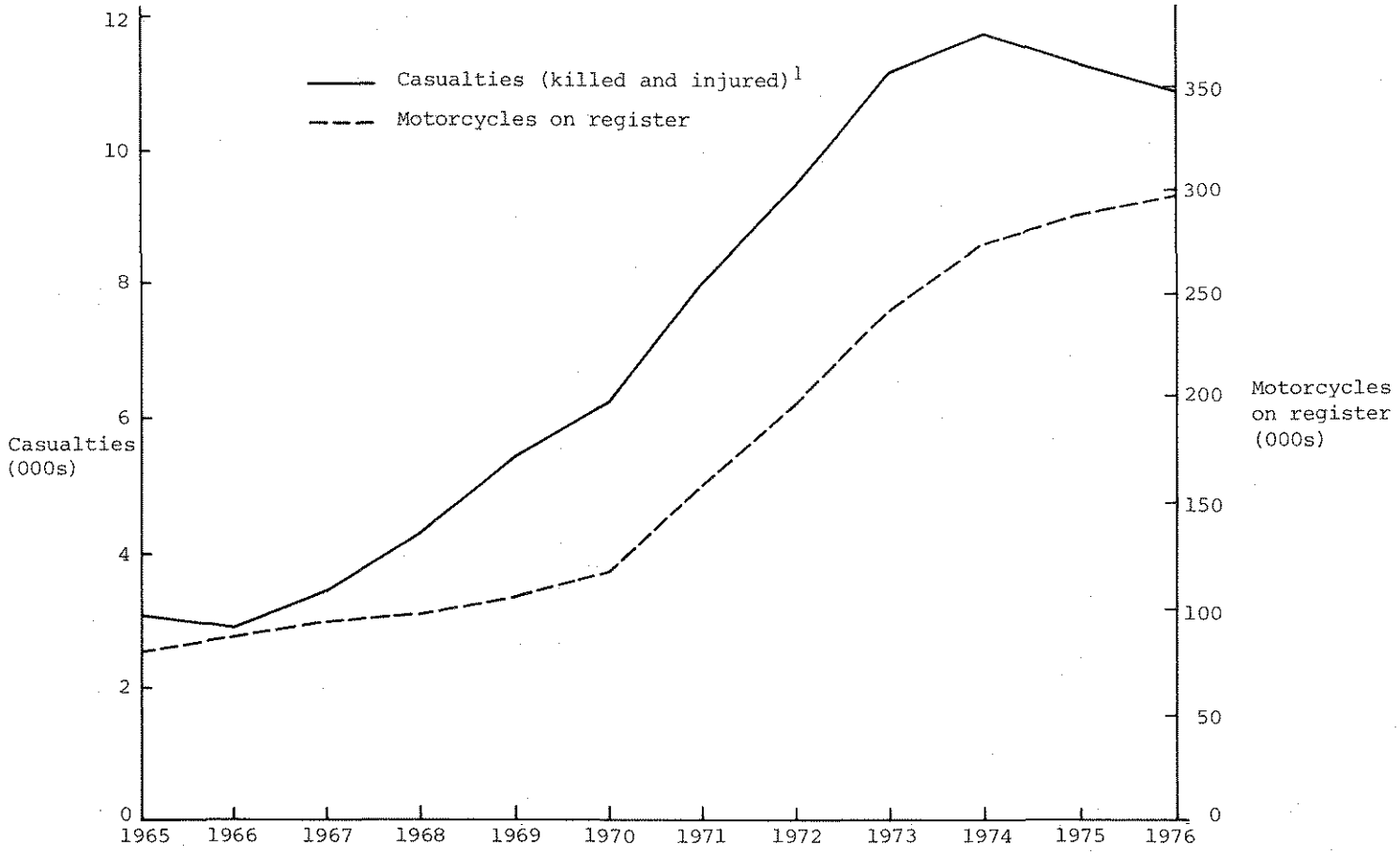
1 Recent data relating casualties to exposure are unavailable. The most recent and detailed data available are for Victoria.

FIGURE 3

MOTORCYCLE CASUALTIES AND REGISTRATIONS



1. Excludes pillion passengers.

Source: ABS Road Traffic Accidents involving Casualties;
ABS Motor Vehicle Registrations.

19. Motorcycle pillion passengers are not included in motorcyclist casualty figures but are included with vehicle occupants. A 3 month study carried out in New South Wales in 1975 found that one-tenth of motorcyclist casualties are pillion passengers[1], which probably leads to a 10% underestimate of the size of the problem. In addition, data is not available on off-road casualties. It was reported at a seminar in May 1977, held by the Royal Australasian College of Surgeons, that 40% of all motorcyclists treated at a major Victorian rural hospital were injured on farms and trails.

- Accident Characteristics

20. Within the rider population, research has shown that riders face varying levels of risk depending on their age, experience and the engine capacity of the machine. The frequency of accidents also varies according to the time of day.

21. Motorcyclist casualty statistics indicate that motorcycle safety is predominantly a problem with teenagers and young male adults. In New South Wales, for instance, evidence indicates that of 159 motorcyclists killed in 1975 for whom age was established, 129 were under 25 years of age. Among the 142 motorcyclists killed at the controls, 138 were males. These and confirming data for Australia and from individual States are summarised in Appendix 4. Appendix 4 also shows accident probability for a range of ages based on South Australian data for 1973. This data shows markedly higher accident probabilities for riders under the age of 25 years, particularly for those aged 16-20 years.

22. Rider inexperience and lack of training are dominant factors in motorcycle accidents. Summaries of statistical material for New South Wales, South Australia and Tasmania demonstrating this relationship are shown at Appendix 5. The data for these States indicates a high percentage of deaths and

1 Evidence, p. 1096.

crashes for riders with less than two years riding experience. The data on South Australia in this Appendix shows that accident probabilities are high in the first two years of riding and then drop substantially. The unexpectedly high accident probability figure relating to riders in their fourth year was not explained in the South Australian study.

23. There is a strong relationship between motorcycle engine capacity and the extent of accident involvement. Table 3 which shows accident probability by engine capacity indicates clearly that the probability of an accident increases with engine capacity and that motorcycles of over 250 cc engine capacity have significantly high levels of accident risk for the predominantly young population concerned. The over involvement of higher capacity motorcycles in motorcycle crashes and fatalities in relation to registered motorcycles can also be seen in the Tables shown in Appendix 6 relating to Tasmania and Western Australia.

24. The interrelationship of rider exposure to accidents in terms of distances travelled, engine capacity and rider age and experience is shown in Tables 4, 5 and 6. Table 4 indicates that as exposure increases accident probability increases markedly, and that at each level of exposure there is a higher accident probability for motorcycles above 250 cc capacity. While the body of this Table does not reveal any consistent relationship between engine capacity, rider experience and exposure it is apparent that the highest accident probabilities are for riders with less than two years experience riding motorcycles above 250 cc more than 4,000 miles per year (6,400 kilometres per year).

25. Tables 5 and 6 show the strong influence of rider age on accident probabilities. These Tables indicate that as age of rider increases the importance of engine capacity in accident involvement decreases. Also, for riders over 25 years and particularly over 30 years, the accident probabilities do not increase markedly as exposure increases, and there is little difference between the accident risk of large and small machines.

TABLE 3

ACCIDENT INVOLVEMENT AND MOTORCYCLE CAPACITY
SOUTH AUSTRALIA, 1973

Capacity (c.c.)	Accident Motorcycles		Non-Accident Motorcycles		Accident Probability
	No.	%	No.	%	
0 - 125	178	28	399	43	5.4
126 - 250	144	22	252	27	6.8
251 - 400	122	19	112	12	12.2
Over 400	198	31	166	18	13.2
Total	642	100	929	100	8.1

Source: I.R. Johnston, P.W. Milne and M.H. Cameron, 'Age, Experience and Motorcycle Engine Capacity in Motorcycle Accidents', *Motorcycles and Safety Symposium*.

TABLE 4

ACCIDENT PROBABILITY BY RIDER EXPOSURE
EXPERIENCE AND MOTORCYCLE ENGINE CAPACITY

Exposure	Eng. Cap.	Months of Motorcycling					TOTAL	TOTAL
Miles/Year	c.c.	0-12	13-24	25-36	37-48	Over 48		
Under 4001	≤ 250	7.2	6.7	4.8	6.7	3.7	5.1	5.5
	> 250	11.3	13.1	3.7	13.0	5.1	7.2	
4001-8000	≤ 250	8.1	12.6	8.8	8.8	3.7	7.0	9.0
	> 250	24.2	23.8	13.3	9.1	8.5	13.0	
8001-11000	≤ 250	9.3	7.1	4.1	3.1	3.5	5.4	10.6
	> 250	24.2	25.4	9.1	17.0	13.3	16.2	
Over 11000	≤ 250	16.1	13.3	6.8	6.0	7.1	9.5	15.4
	> 250	20.4	18.9	20.4	25.7	12.5	18.0	
TOTAL	≤ 250	7.7	8.6	5.9	6.9	3.8	5.9	8.1
	> 250	18.9	19.6	12.3	17.3	8.5	13.0	
TOTAL	ALL	10.1	11.9	8.1	11.6	7.0	8.1	8.1

Source: Johnston, Milne and Cameron.

TABLE 5

ACCIDENT PROBABILITY BY RIDER EXPOSURE
AGE AND MOTORCYCLE ENGINE CAPACITY

Exposure	Eng. Cap.	Age				Total	Total
Miles/Year	c.c.	16-20	21-25	26-30	Over 30		
Under 4001	≤ 250 > 250	8.5 11.7	6.3 8.4	3.6 1.2	3.1 4.3	5.1 7.2	5.5
4001-8000	≤ 250 > 250	11.7 21.6	4.8 10.3	3.5 13.3	4.9 5.7	7.0 13.0	9.0
8001-11000	≤ 250 > 250	5.4 16.1	5.2 22.4	11.4 8.8	4.9 7.9	5.4 16.2	10.6
Over 11000	≤ 250 > 250	6.7 21.2	5.2 17.2	8.8 2.5	2.5 1.4	9.5 18.0	15.4
TOTAL	≤ 250 > 250	9.4 21.8	5.6 13.1	3.8 5.1	3.4 4.9	5.9 13.0	8.1
TOTAL	ALL	12.6	8.5	4.1	3.8	8.1	8.1

Source: Johnston, Milne and Cameron.

TABLE 6

ACCIDENT PROBABILITY BY RIDER EXPOSURE,
AGE AND MOTORCYCLE ENGINE CAPACITY

Exposure (Miles/Year)	Engine Capacity (c.c.)	Age	
		16 - 25	26 +
Up to 8000	≤ 250	8.0	3.5
	> 250	12.9	4.9
Over 8000	≤ 250	7.5	5.6
	> 250	19.2	5.3

Source: Johnston, Milne and Cameron.

26. In summary, the relationships demonstrated in the foregoing Tables indicate that high motorcycle accident probability is strongly associated with riders of less than two years riding experience, aged 25 years or less riding motorcycles of above 250 cc engine capacity.

27. The apparent importance of young inexperienced riders and high engine capacity in motorcycle accidents led many witnesses and the Committee to consider measures for dealing with motorcycle crashes. These countermeasures have included proposals for tougher licence tests, limitation of newly-licensed riders to low capacity motorcycles, better pre-licence rider training and restrictions on the sale of high capacity motorcycles. The Committee considered these proposals in detail and discusses them in later sections of this Report.

28. Most motorcycle accidents occur during daylight hours. The Australian Capital Territory Police said that, in 1976, of a total of 466 motorcycle accidents 74% occurred in daylight.[1] The Traffic Accident Research Unit (TARU) found in a New South Wales study that the most common time crashes occurred was in the late afternoon period with a peak on Fridays. Details of the crashes in this study are shown at Appendix 7. The Tasmanian Transport Commission reported that 73% of all reported motorcycle crashes in Tasmania occur during daylight.[2]

29. Evidence received from a number of sources indicates that there is a significant proportion of motorcyclists who are unlicensed riders. A survey in metropolitan areas of Perth in April 1976 was conducted by the Western Australian Road Traffic Authority to assess the numbers of unlicensed motorcyclists. These checks revealed that 46, or 12%, of the riders were violating the licence laws including riding under suspension, no motorcycle licence, incorrect class of motorcycle licence, and contravening conditions of an extraordinary licence.

1 Evidence, p. 68.
2 Evidence, p. 1295.

30. A recent study by TARU found that in New South Wales over 8% of motorcyclists involved in crashes studied were unlicensed.[1] This study also found that many newly licensed riders have several years riding experience.[2] Dr Paul Robinson[3], Director of Orthopaedics, Royal Brisbane Hospital, told the Committee that, in a six months' survey of motorcycle crash victims, 10 out of 80 patients (12½%) were unlicensed.

- Accident Causes

31. Evidence was received on local and overseas investigations into factors contributing to motorcycle accidents.

32. Table 7 lists factors attributed by the Tasmania Police as being responsible for motorcycle crashes and casualties in Tasmania over a three year period. It was stated that 67% of those injured were in the following categories:

. driving ability impaired by alcohol;
. excessive speed;
. failing to give right of way;
. inattentive riding;
. incorrect overtaking;

and that these factors match fairly closely the main factors involved in motor car crashes.

33. Single vehicle type accidents account for about 25% of motorcycle accidents in Australia.[4] The most important element

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1 R.G. Vaughan, K. Pettigrew and J. Lukin, *Motorcycle Crashes: A Level Two Study*, Traffic Accident Research Unit, Department of Motor Transport, New South Wales, Report No. 2/77, p. 26.

2 Evidence received by the Committee and other studies have indicated that licence permit holders often have extensive riding experience. Riding experience is therefore not directly dependent on the licence status of riders.

3 Evidence, p. 1521.

4 Evidence, p. 559.

TABLE 7

TOTAL NUMBER OF MOTORCYCLE CRASHES
AND CASUALTIES BY CAUSES FOR THREE YEARS 1973-75
WITH PERCENTAGES OF THE TOTALS, TASMANIA

Responsibility Attributed to:-	No. of Crashes	% of Total	No. Killed	% of Total	No. Injured	% of Total
Crashes involving Alcohol where Rider's B.A.L. was .05 or more.	56	16%	17	56%	48	13%
Excessive Speed Regarding Conditions	58	17%	2	7%	67	18%
Failing to Keep Left	13	4%	1	3%	14	4%
Failing to Give Right of Way	35	10%	2	7%	35	10%
Inexperience	47	13%	3	10%	47	13%
Inattentive Riding	49	14%	1	3%	53	15%
Overtaking Without Sufficient Clearance	35	10%	-	-	43	11%
Following Another Vehicle Too Closely	16	5%	2	7%	17	5%
Other Alcohol Causes	8	2%	2	7%	6	2%
Other Motorcycle Causes	31	9%	-	-	32	9%
TOTAL:	348	100%	30	100%	362	100%

Source: Evidence, p. 1372.

in causing this type of accident is the rider. In Australia research has indicated that the rider is at fault in almost all single motorcycle crashes.[1] Table 1 in Appendix 8 sets out the results of a United States study on accident culpability. This study allows more weight to other causes related to vehicle condition, environmental factors and the action of other vehicles. The rider was held to be culpable in 44% of single urban non-intersection accidents and in 36% of single rural non-intersection accidents.

34. In motorcycle-vehicle accidents, which account for about 75% of motorcycle accidents in Australia, the vehicle driver was found to be at fault in about two thirds of these accidents.[2] Tables 1, 2, 3 and 4 in Appendix 8 show the level of culpability attached to the rider, driver and other factors contributing to motorcycle-vehicle collisions in studies conducted in the United States, Japan and Belgium. These studies also found that the vehicle driver is the most important factor, followed by the rider, and that other contributing factors are relatively unimportant.

35. These studies and other evidence received indicate that the major contributing factors in motorcycle accidents are the lack of pre-licence training for riders in driving techniques, lack of visibility of the motorcycle to other road users and a general lack of awareness and appropriate response by other road users to the presence of motorcycles. These areas received detailed consideration by the Committee. The importance of these factors is highlighted by studies of on road motorcycle accidents in New South Wales which revealed that 78% of motorcycle fatalities occurred in urban traffic conditions[3] and that 86% of motorcycle traffic crashes occurred in areas where 0-60 kilometre per hour speed limits apply.[4]

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1 Evidence, p. 1636.
2 Evidence, pp. 558-9.
3 Evidence, p. 555.
4 Vaughan, Pettigrew and Lukin, p. 51.

36. A recent study[1] of motorcycle fatality and injury accidents reported to Victoria Police during 1974 revealed that alcohol was a significant factor. Similar results were indicated by other Australian studies reporting on post-mortem examinations of motorcycle riders. The study of Victorian data drew the following conclusions. Alcohol affected riders were significantly over represented in fatal and single vehicle accidents. The majority of killed riders had blood alcohol levels typical of problem drinkers. Motorcycle riders had similar blood alcohol levels to a comparable group of drinking car drivers but a significantly lower proportion of killed motorcycle riders were affected by alcohol than killed car drivers. Motorcycle riders affected by alcohol were mainly younger than 25 years of age, but this was probably a reflection of the youthfulness of the motorcycle riding population as a whole.

37. Visual defects of the driver were reported to the Committee by some witnesses to be a cause of accidents. The Australian College of Ophthalmologists informed the Committee however that a survey in New South Wales indicated that only 1% of all traffic accidents were caused by physical defects and that this figure includes visual defects. The College suggested that as colour vision defects affect 8% of the male population, and if such a common defect was the cause of accidents, then visual defects should assume a higher percentage than the 1% of traffic accident causes.[2]

- Injury Patterns and Helmet Usage

38. The Committee received evidence on various studies into the pattern of injuries sustained by motorcyclists involved in traffic accidents.

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1 M.J. Williams, *Motorcycle Accidents and Alcohol Use*, 7th International Conference on Alcohol, Drugs and Traffic Safety, Melbourne, January 1977.

2 Evidence, p. 1506.

39. A study[1] of New South Wales motorcycle accidents based on Police descriptions of injuries amongst riders and pillion passengers killed indicates that head injuries of various types accounted for nearly half of the reported injuries. Unfortunately no description of injury type was given by Police for more than half of all injuries to the road users killed. More than two-thirds of the reported injuries to motorcycle riders and pillion passengers in this study were to the arms and particularly to the legs. A summary of the location of injuries received in this study is shown at Appendix 9.

40. A smaller but more intensive study of injury was conducted in Victoria by Dr Trinca and Mr Dooley of the Royal Australasian College of Surgeons' Road Trauma Committee. They studied the medical records and X-rays of 212 motorcycle injury patients admitted to four Victorian hospitals during 1974 and 1975. The pattern of injury sustained in this study is shown in Table 8.

TABLE 8

MOTORCYCLIST INJURIES

Body Region Affected	Killed (n=100)	Injured (n=212)
Head, Face, Neck	58%	14.2%
Vertebral		3.8%
Thorax and Lower Torso	81%	9.0%
Lower Extremity	37%	74.1%
- Lower leg only		51.4%
- Foot only		10.8%
- Amputation of Foot		3.8%
Upper Extremity	18%	22.2%
- Carpal bones and hands		5.2%

Source: Evidence, pp. 825-827.

1 Vaughan, Pettigrew and Lukin.

41. In a separate study of 100 consecutive fatal motorcycle accidents between 1973 and 1974 Dr Trinca and Mr Dooley found that the majority had died from serious head and/or serious torso injury. The pattern of injury observed in this study is also shown in Table 8. It can be seen from this Table that injuries of those surviving motorcycle accidents are confined mainly to severe local injuries to the extremities particularly the leg.

42. A study[1] of motorcycle crashes was undertaken in New South Wales in 1975 to evaluate the facial protection given in crashes by different helmet types. The study found that there are two main types of helmet in usage; the 'jet' style where the protective shell extends to the base of the skull and the side of the head and the 'full-face' style where the protective shell is extended further to cover the mouth and jaw. The incidence of the usage of these helmets is shown in Table 9. The location of injury classified by the type of helmet worn shown in Table 10 indicates that full-face helmets provide significantly greater protection against facial injury than do jet style helmets.

43. While full-face helmets seem to give real protection to the face, they are more expensive, heavier and more restrictive of vision than are jet helmets. Some motorcyclists claimed that the two last aspects increase the risk of crashing and thus nullify the facial protection benefits. This aspect was examined in Vaughan's study which concluded that on the basis of available accident statistics the wearing of a full-face helmet is not associated with a greater chance of involvement in a road traffic crash.[2]

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1 R.G. Vaughan, 'Motorcycle Helmets and Facial Injuries', *The Medical Journal of Australia*, 1977, 1: 125-127.

2 Evidence, p. 1636.

TABLE 9

TYPES OF HELMETS WORN BY MOTORCYCLE RIDERS

Helmet Type Worn	Number of Motorcyclists	
	Observed by Survey in Sydney	Involved in Crashes in Sydney
Full-face style	743 (58%)	521 (56%)
Jet style	534 (42%)	407 (44%)
TOTAL	1,277 (100%)	928 (100%)

Source: Vaughan, 'Motorcycle Helmets and Facial Injuries'.

TABLE 10

LOCATION OF INJURY CLASSIFIED BY TYPE OF HELMET WORN

Location of Injury	Number of Motorcyclists and Pillion Passengers	
	Wearing full-face helmet	Wearing jet style helmet
Whole Body	24 (3%)	18 (2%)
Head	46 (6%)	53 (7%)
Face	26 (3%)	64 (8%)
Neck	5 (1%)	6 (1%)
Upper extremities	187 (24%)	183 (23%)
Back	15 (2%)	21 (3%)
Chest	15 (2%)	12 (2%)
Abdomen	13 (2%)	6 (1%)
Pelvis	25 (3%)	31 (4%)
Lower extremities	335 (44%)	313 (40%)
Unknown	77 (10%)	77 (10%)
Total	768 (100%)	784 (100%)

Source: Vaughan, 'Motorcycle Helmets and Facial Injuries'.

Bicycles

- Production and Imports

44. With the exception of bicycle frames, most of the components used in the assembly of bicycles in Australia are imported. Significant numbers of fully assembled bicycles have been imported in recent years. Table 11 shows the level of bicycle production and imports over recent years.

TABLE 11

AUSTRALIA - BICYCLE PRODUCTION AND IMPORTS

('000)

	Manufacturered or assembled	Imported	Total
1965/66	64	2	66
1966/67	69	2	71
1967/68	91	2	93
1968/69	115	2	117
1969/70	127	2	129
1970/71	124	8	132
1971/72	129	6	135
1972/73	165	10	175
1973/74	191	47	238
1974/75	188	89	277
1975/76	188	95	283

Sources: ABS, Production Statistics.
ABS, Overseas Trade Bulletins.

45. From Table 11 it can be seen that between 1970 and 1975 the numbers of manufactured or assembled and imported bicycles increased by 114%.

46. Evidence indicates that there were over 50 bicycle assemblers and importers competing in the Australian market in 1975, and that the two largest suppliers held slightly less than half of the market.

- Accident Statistics

47. The availability of statistical information on bicycle accidents is minimal compared to other forms of transport.

48. Bicycles are not subject to registration and there is no information available on the number of bicycles in Australia. There is also no data available on bicycle exposure, and casualty and accident rates can not be calculated.

49. Published statistics enable the following trends to be observed over the period 1963-76. The number of collisions, deaths and injuries of cyclists involved in road accidents has fallen; the highest number of accidents involving casualties is in the 7 and under 17 age group; the majority of accidents involve male cyclists; and collisions between bicycles and motor vehicles are the most common type of accident and the one causing the greatest number of casualties. These published statistics are summarised at Appendix 10.

50. Published data significantly under estimates the extent of bicycle accident involvement. Many bicycle accidents are not reported to the police especially where no other vehicle is involved. A survey in February 1977 of secondary school students in Geelong, Victoria conducted in association with the Geelong Bikeplan[1] study, asked student cyclists details of any bicycle accidents during the last year that required medical attention. The ratio of unreported to reported accidents was up to 30 to 1 in this study.

51. The Geelong Bikeplan survey is the most comprehensive study to be carried out in Australia. The following findings and statistics from the Geelong survey may give a general indication of the pattern of bicycle accidents for Australia.

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1 *Geelong Bikeplan*, Study Report, Geelong Bikeplan Study Steering Committee for the Victorian Government, Melbourne, 1978.

Bicycle accidents occur everywhere, some 60% occur at intersections and 40% occur at mid-block. Right-angle collisions are the most common form of accident at 41% and of these 32% occur at intersections and 9% at mid-block. 'Struck from behind' accidents account for 24% of total bicycle accidents, the majority being due to the bicycle 'merging' into the front of the motorist.

52. The severity of bicycle accidents increases with night cycling and wet weather cycling. On a wet night, a cyclist is 20 times more likely to receive a fatal injury than on a dry day. Less than 40% of bicycles involved in accidents at night were known to have carried some form of lighting.

53. The study found that the majority of bicycle accidents involved and were caused by children. Some 72% of bicycle accidents occur to the 7-17 year age group, whilst the 12-14 year age group accounts for around 33% of total accidents reported in Victoria. In 1975 the cause of some 70% of Victorian fatal bicycle accidents and 65% of Geelong bicycle accidents could be attributed to the cyclist. The study found that the rate of initiation of accidents with motor vehicles for cyclists over 18 years of age at 40% was almost half that of younger cyclists. It was suggested that the lower initiation of accident rate for these cyclists is probably due to experience, awareness of danger, knowledge of road rules as well as age and responsibility.

54. The study found that while the cycling population is predominantly young the greatest potential for increase in bicycle use is with adults and school children over the age of 15 years. It was also found that cyclists frequently use and favour main roads which are direct, have a good surface condition for cycling, have priority at intersections, are controlled by traffic lights and contain most destination points. Up to 80% of

adult cycling was estimated to be on main roads and it was concluded that the advantages of main road cycling will usually outweigh the disadvantages and risks associated with higher traffic levels.

Availability of Accident Data

55. The Committee was deeply concerned about the inadequacy of road accident data available at the national level. Extensive comment was made on this problem in Chapter 14 of the Committee's report on *Passenger Motor Vehicle Safety*. The Committee believes that the need to implement a uniform accident report form throughout Australia is of major importance and that the lack of such basic data is hampering analysis of road safety problems in Australia. The Committee is aware that the Australian Transport Advisory Council has recently considered this matter and recommends that:

- *States and Territories amend their road accident report forms to include the list of common items recently endorsed by the Australian Transport Advisory Council.*

CHAPTER 3

MOTORCYCLE SAFETY

Introduction

56. Research into factors involved in motorcycle safety has been discussed in the previous chapter. This research highlighted the high level of accident involvement of young, inexperienced riders and motorcycles with high engine capacity, the essential vulnerability of motorcycle riders in collisions together with the recent boom in motorcycle numbers, crashes and resultant casualties. The Committee has taken these factors into account in its consideration of appropriate countermeasures.

57. This chapter focuses attention on means to avoid accidents through measures affecting the vehicle, rider, road and traffic and on means to provide increased rider protection.

58. Before considering the scope for appropriate solutions to the motorcycle safety problem there are a number of features of the motorcycle relating to its use and market in Australia that the Committee wishes to comment on.

59. The term 'motorcycle' covers a range of different special purpose vehicles. Table 1 on page 7 indicates that typically machines of above 250 cc engine capacity are used solely on the road both for commuting and pleasure, and it is for this class of vehicle that most of the discussion in this chapter is applicable. A high proportion of machines of lower engine capacity are not registered for use on the road. Such machines are used for off-road recreational, agricultural and competitive purposes.

60. There is also a category of low capacity dual purpose on and off-road vehicles which are required to be registered. These machines are used off-road to a substantial degree but due either to choice or to need for general mobility must be driven

to off-road areas. The Committee is aware that the performance requirements of vehicles used on the road may differ from those required by riders of machines in off-road areas. In particular, road registration requirements in areas such as braking, tyres and flashing light indicators may be inappropriate for off-road usage and may even debar the use of the safest and most effective equipment for vehicle control appropriate to off-road conditions. While the Committee is aware that there may be problems with dual usage, very little evidence was received on this aspect. The Committee therefore recommends that:

. *differing safety requirements for those motorcycles used both on and off the road be given due consideration by authorities proposing safety requirements for this class of motorcycle.*

61. A further category of low powered two-wheeler, commonly referred to as mopeds[1], is widely used in the United States, Japan, United Kingdom, France, etc., but has not been marketed in Australia in any significant quantity. Overseas, mopeds are often explicitly defined as not being motorcycles and are treated differently from motor vehicles within the meaning of the Acts as interpreted in Australia. Few countries require a licence or special testing for such vehicles and in most cases the wearing of helmets is not compulsory. The age distribution of those using mopeds overseas parallels the general population rather than the specialised young male adult characteristics of the motorcycle market in Australia. The Committee considers that under certain conditions motorcycle safety could be enhanced through greater use of mopeds. This matter is discussed in Chapter 5.

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1 Mopeds are subject to slightly different definitions in various countries of the world. In general terms a moped can be described as a two-wheeled vehicle with a propelling engine having a piston displacement of up to 50 cc and a maximum speed of 60 kilometres per hour, which can also be propelled as a pedal cycle.

62. As virtually all motorcycles are imported into Australia there are severe limitations on the extent to which requirements unique to this country can be introduced. Introduction of such requirements could impose severe cost penalties on those vehicles imported in low volume for the Australian market. Consequently reliance has been placed on compliance of imported motorcycles to vehicle design requirements of overseas regulatory bodies. In these circumstances it is important that Australia continues to participate in international rule-formulation processes. There is scope however for appropriate overseas requirements to be incorporated into Australian rules and regulations. Australian Design Rule 28, Motor Vehicle Noise, and Australian Design Rule 33, Motorcycle Brake Systems, (ADR 33) are based on overseas standards as are a number of Draft Regulation requirements for motorcycles. Details of safety related Australian Design Rules and Draft Regulations for motorcycles are shown at Appendix 11 together with a brief description of the bodies associated with the introduction of these regulatory measures. Appendix 11 also contains standards required in the United States and the Economic Community of Europe (ECE) which have not been taken up by Australian requirements. The Committee recommends that:

. *the Advisory Committee on Safety in Vehicle Design keep under review the need to take up relevant overseas design requirements for motorcycles.*

Motorcycle Primary Safety

- Braking

63. A motorcycle rider requires brakes which will stop a motorcycle under emergency conditions in the shortest possible distance without locking the wheels and losing control. Research indicates that accidents occur because brakes were inadequate or incorrectly applied for the prevailing conditions and that skidding as a factor in casualty accidents is significantly more

prevalent on wet as compared to dry roads. Braking performance and machine stability are also affected by machine camber and weight transfer due to deceleration.[1]

64. Motorcycle braking technology has made significant advances. Existing machines use single, double or triple disc brakes with stopping capabilities far superior than in earlier times.

65. The deterioration in braking performance of disc brakes in wet weather is of concern and the Committee was informed[2] that Japanese manufacturers are researching various ways to solve the problem. Research has indicated that mechanical sources of improving wet weather braking performance are the material of the disc and pad.

66. Honda has suggested[3] that much of the wet weather disc brake problem is due to the inexperience of riders in recognising the different wet and dry response characteristics of disc brakes as shown in Figure 4. In wet weather Honda claims riders need to apply double the pressure on the disc brake lever, a reaction which many experienced motorcyclists find hard to do as a result of their trained reactions linked to dry conditions.

67. Several witnesses referred to long delays in effective braking with several makes of front disc brakes in wet conditions. Honda and Yamaha[4] have reported inconclusive results from

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1 P.M.E. Wilson, *Motorcycle Braking*, International Conference on Automobile Electronics, 6-9 July 1976, London.

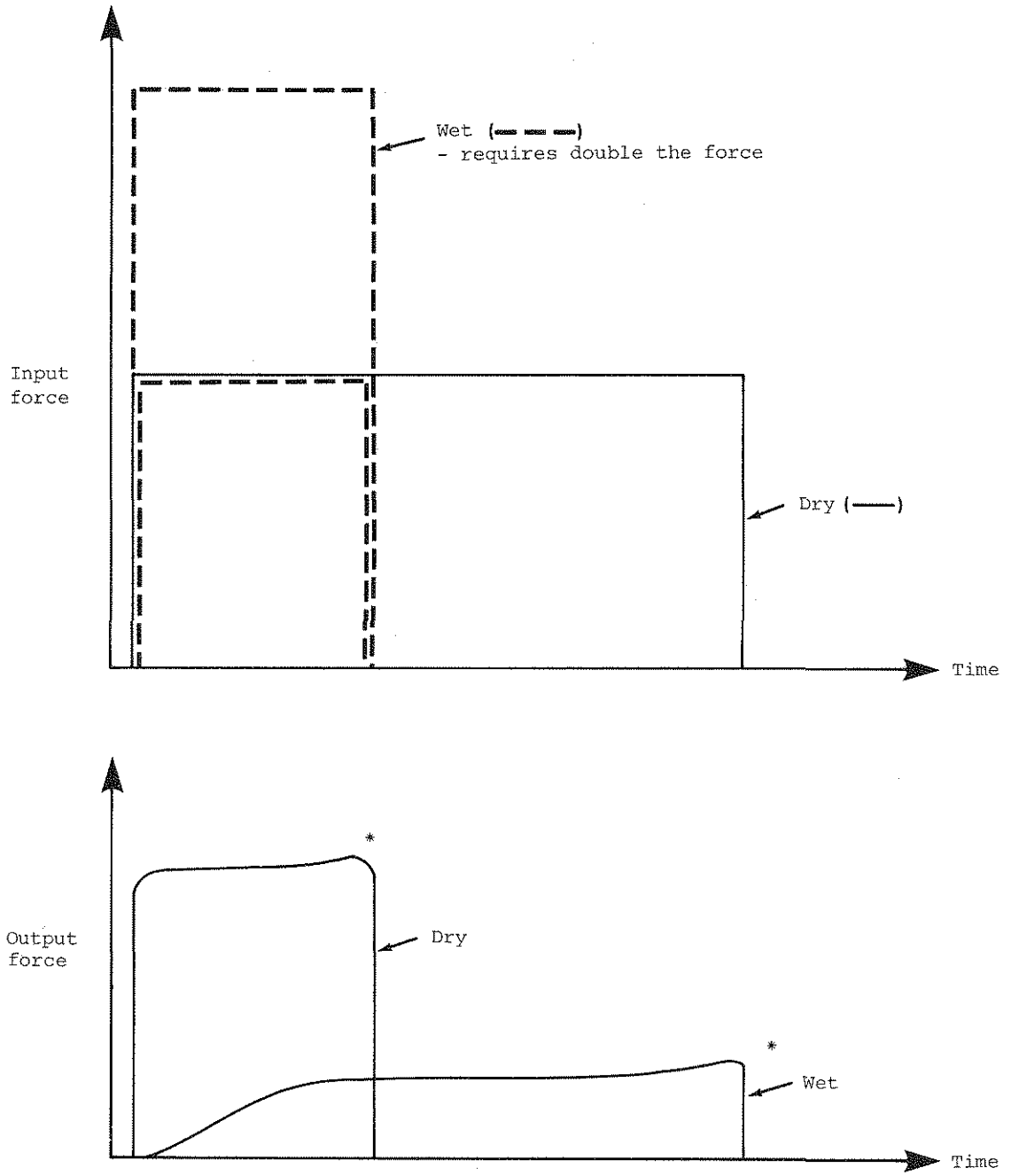
2 M.R. Wigan, *Motorcycle Safety, Transport and Traffic Control Overseas Visit Report: Japan (August 1977)*, Australian Road Research Board, Research Report ARRB No. 78.

3 Wigan, *Motorcycle Safety: Japan (August 1977)*.

4 Wigan, *Motorcycle Safety: Japan (August 1977)*.

FIGURE 4

WET AND DRY RESPONSE CHARACTERISTICS - DISC BRAKES



* Rise exaggerated for presentation

Source: Wigan, *Motorcycle Safety: Japan (August 1977).*

drilling holes in disc brakes to improve their performance. The Committee considers that an experimental appraisal of discs machined with angled slots should be conducted using the revised United States wet weather brake test procedure, with the aim of adding wet weather disc brake reaction time requirements to a revised ADR 33.

68. Operation of front and rear brakes together by applying the correct proportion of braking effort to each wheel is a skilled operation of particular concern even to experienced riders. Skidding is a particularly hazardous situation to be avoided on a motorcycle as directional control of the vehicle is lost and a spill is extremely likely. Many experienced riders are consequently frightened to use their front brake and are thereby more than doubling their braking distance in an emergency by using only the rear wheel brake.[1] The Committee therefore recommends that:

- *a requirement for licensing be a demonstration of the effective use of all brakes fitted to the motorcycle particularly the front brakes;*

and

- *the Commonwealth Department of Transport develop advisory performance specifications for this test.*

69. Considerable effort in the United Kingdom, United States and Japan is being directed towards development of anti-skid motorcycle braking systems. Several systems have been developed of which not all have been successful and none as yet fully proven for production purposes. Experiments with some of these systems have demonstrated a most important advance in motorcycle stability while braking, particularly on wet surfaces and on wet curves. The main advantage of these systems is that they bring to virtually every rider the ability to brake swiftly in comparable distances to expert riders, while in wet conditions

1 Evidence, p. 1115.

they enable even expert riders to achieve best braking performance with far less risk of a fall. The Committee therefore recommends that:

. *positive steps be taken to appraise developmental anti-lock motorcycle braking systems by experiment within Australia.*

70. The difference between the physical capability of front brakes and the performance by riders is substantial.[1] Several witnesses have pointed to the benefits of the Moto Guzzi coupled braking system which involves single front and single rear disc brakes linked by a load splitting device actuated by the foot pedal, as well as incorporating an independent single front disc brake operated by the conventional handlebar lever. The claimed benefit is that a greater proportion of braking capability can be exploited by the average rider. The Committee therefore recommends that:

. *experiments be undertaken to assess the physical performance of, and the ability of riders to make better practical use of, coupled braking systems as exemplified by Moto Guzzi with a view to encouraging wide use of this type of system if shown to demonstrate an added margin of safety.*

71. Australian Design Rule 33 on Motorcycle Brake Systems was implemented in March 1976. It includes design and performance requirements for front and rear brakes used together and individually, fade tests, and tests after immersion in water.

72. This rule, however, appears to have been formulated with insufficient consideration of the limited ability of some sections of the motorcycle industry in Australia to demonstrate compliance. As a result procedures for demonstrating compliance were simplified. These simplified procedures have been applied

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1 Evidence, p. 1115.

particularly to small importers. The Committee therefore recommends that:

. *Australian Design Rule 33, Motorcycle Brake Systems, be reviewed to ensure that proof of compliance requirements are brought within the capacity of the Australian motorcycle industry.*

73. Attention has also been drawn to other difficulties in the test procedures in ADR 33. In particular the Committee was informed that the design of certain vehicles made it impossible to comply with the ADR 33 requirement that the engine be disengaged during braking tests. This applies to machines fitted with automatic clutches and automatic transmissions and without a separate device for engine disengagement. The Committee recommends that:

. *motorcycles utilising automatic clutches and automatic transmissions without a separate device for engine disengagement should be taken into account in the revision of Australian Design Rule 33.*

- Steering and Handling

74. The main matter concerning steering and handling raised in evidence particularly by State and Territory police departments was the instability of some models of motorcycles when fitted with fairings. The Australian Capital Territory Police stated that the handling qualities of their vehicles fitted with handlebar fairings attached to the steering arms in conjunction with full police equipment on the machine at various points were drastically impaired at speeds above 130 km/h. At this speed it was stated the wind buffeting set up a wobbling action which was transmitted to the steering and the machine became uncontrollable. Fairings which are fixed to the frame rather than to the steering arms appear to reduce this problem (see Figures 5 and 6).

75. A properly designed fairing will, by holding the machine harder onto the road, enhance the safety and stability of the machine. It also protects the rider from wind buffeting and thereby reduces rider fatigue.

76. Manufacturers' recommendations are not provided as to the suitability of the types, sizes and brands of fairings available on the market. As motorcycles are designed for aerodynamic balance the Committee considers that it is important for fairings to be matched to the individual brand and engine capacity of machines and to carry a manufacturer's endorsement.

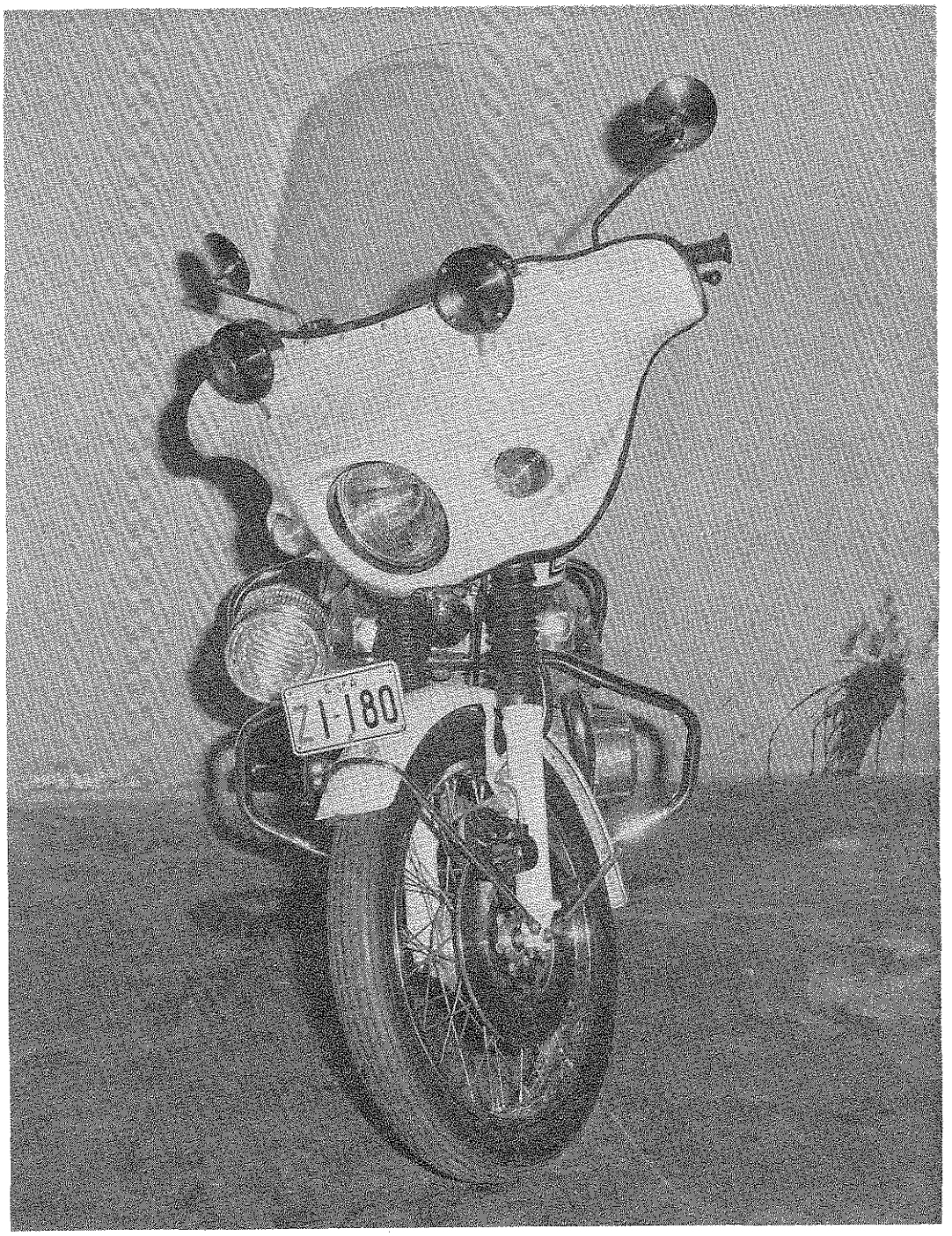
77. Japanese manufacturers indicated that there is considerable effort devoted to improving stability through motorcycle design with resultant improvements in handling. The fitment however of unapproved accessories, for example, panniers, windscreen fairings, etc., can have unpredictable results in this area.

78. Similarly, the distribution of weight on a motorcycle can contribute to instability. The considerable weight of radio and other equipment carried at the rear of police motorcycles could be a contributory factor to the instability problems experienced.

79. It is significant that similar problems have been faced elsewhere and have been complained about vociferously by users in Europe and the United States. In the United States manufactured fairings, baggage carrying equipment, etc., are now being sold by motorcycle manufacturers as original optional extras in that market. This appears to be an area where informed consumer pressure has been effective in the absence of any legislative moves.

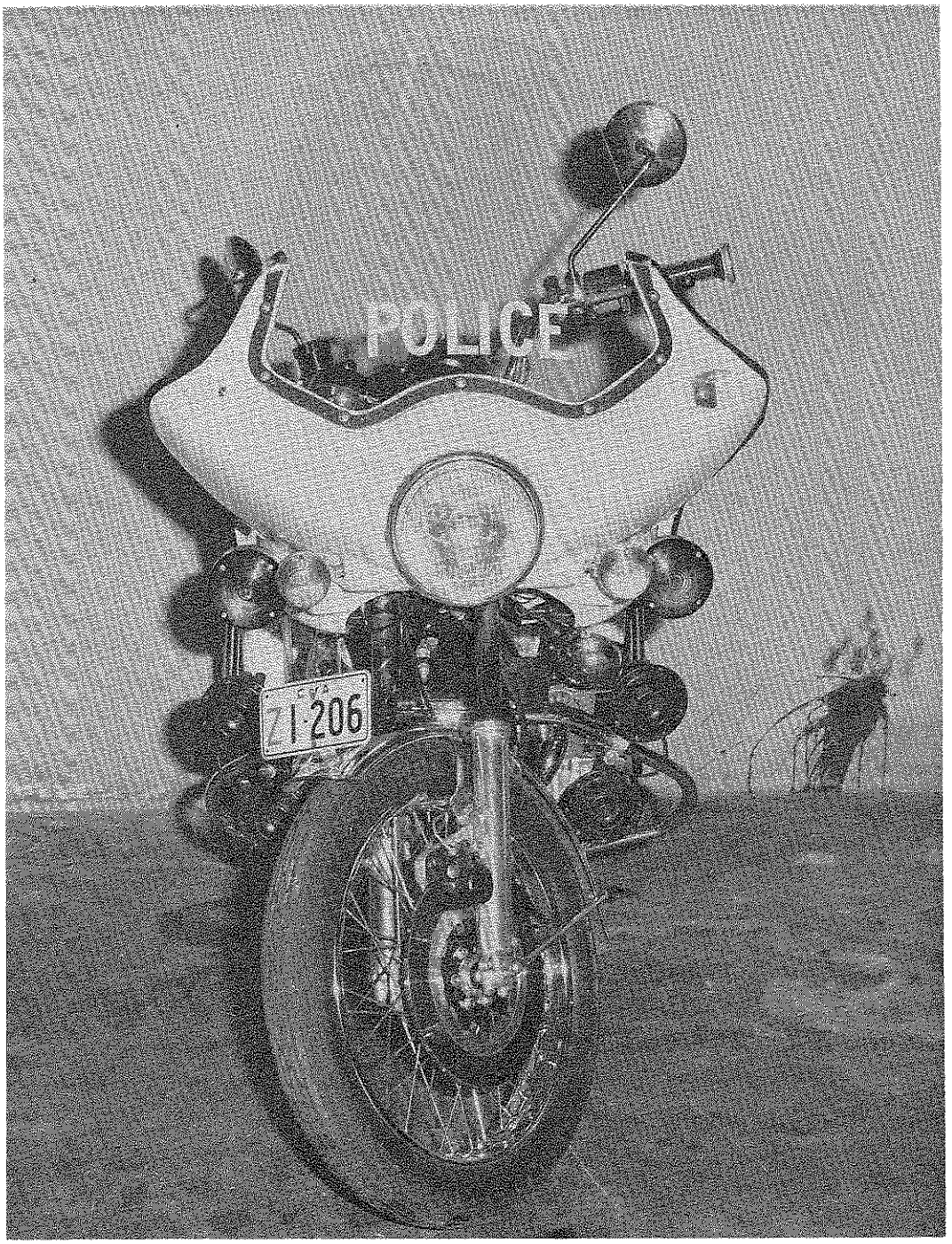
80. Accidents have resulted in Australia due to problems of instability induced by attaching unapproved accessories.

FIGURE 5



Source: ACT Police - Motorcycle fitted with fairing attached to steering arms.

FIGURE 6



Source: ACT Police - Motorcycle fairing not attached to steering arm.

The Committee therefore recommends that:

- *motorcycle manufacturers provide as original equipment optional fairings and luggage carrying equipment endorsed as suitable to the Australian market;*
- *the Advisory Committees on Safety in Vehicle Design and Vehicle Performance draft regulations restricting fitment to motorcycles of accessories likely to produce problems in vehicle stability;*

and

- *the Publicity Advisory Committee on Education in Road Safety in consulting with motorcycle user groups consider the need for assembling and publicising consumer information with regard to the fitment of accessories likely to introduce stability problems to motorcycles.*

81. The Committee recommends that:

- *a literature and research review of existing and potential problems relating to motorcycle stability and handling be undertaken by the Advisory Committee on Safety in Vehicle Design.*

82. Research into primary stability and handling of motorcycles is known to be a very difficult area. The Committee was informed[1] that research through computer simulations of handling and accident avoidance characteristics is advancing the state of the art in relation to motorcycle design characteristics reasonably rapidly in countries other than Australia. It is not yet possible, however, with test systems presently available to define overall handling and performance.

83. Improvement of steering performance is an important part of research being undertaken by Japanese manufacturers. This research is establishing standards with which to measure

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1 Wigan, *Motorcycle Safety: Japan (August 1977).*

the dynamic characteristics of motorcycles. Tests of vehicle stability and manoeuvrability are conducted under varying conditions of acceleration, speed and wind. Test results, however, are substantially affected by the skill of the rider and development through mathematical simulation will be an important subject to be studied in the future.

84. Primary standards of safety involving handling and accident avoidance capabilities of motorcycles although designed into the vehicle must be exploited by the rider if they are to be of benefit. The motorcycle therefore must not be considered on its own. The motorcycle rider and possibly the pillion passenger should be considered as a joint entity for all primary safety issues.

- Tyres and Wheels

85. Tyres are a critical safety item. They must transmit steering, braking and acceleration forces as well as support the weight of the machine and rider. Improved rubber compounds have improved road holding and performance and, with the exception of wet weather braking performance, available tyres perform efficiently with little criticism being offered by riders. The considerable number of objections to Japanese tyres as previously fitted referred mainly to products with longer life but inferior road adhesion to European replacements. Market forces have produced a marked and continuing improvement in the absence of regulations to date.

86. Suggestions have been made that off-road tyres when used on sealed roads are more inclined to skid and hence lead to crashes. A recent study[1], however, does not indicate that prohibiting the use of tyres with off-road treads on sealed roads is warranted.

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1 R.G. Vaughan, 'A Study of Motorcycle Crashes', *Motorcycles and Safety Symposium*, Australian Road Research Board and Commonwealth Department of Transport, Melbourne, 18 June 1976.

87. Tyre performance characteristics are affected by the tyre's construction, materials from which the tyre is made and tread pattern. Work on aspects of tyre performance is being conducted overseas in order to improve both wet and dry surface braking performance.

88. Japanese motorcycle manufacturers also regard tyres as an important item in motorcycle stability. Considerable importance is attached to having a reasonable match between machine and tyre and Honda's usual practice is reported to involve the development of the machine around the selected tyres.[1]

89. The Committee considers that the matching tyre and machine for safety should be further examined. If further examination supports matching of appropriate tyres to each motorcycle then the Committee believes that motorcycle and tyre manufacturers have a responsibility to consult with a view to making recommendations to motorcycle riders on the range of tyres appropriate to each motorcycle model. The Committee recommends that:

- *the Publicity Advisory Committee on Education in Road Safety collate and publicise information on the matching of motorcycle tyres to specific machines.*

90. The Committee was told that aluminium, alloy or cast wheels are safer on motorcycles and unlike spoked wheels they do not require maintenance.

91. There are no Australian Design Rule requirements at present for motorcycle tyres, wheels and rims. There are, however, certain requirements of tyres in Draft Regulation 802 and a current draft Australian Standard on motorcycle tyres.

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1 Wigan, *Motorcycle Safety: Japan (August 1977)*, p. 6.

In view of the importance of tyres and wheels to motorcycles there is a need for further regulation in this area. The Committee therefore recommends that:

- *the Advisory Committee on Safety in Vehicle Design draft design rules on motorcycle tyres, wheels and rims;*

and

- *the Advisory Committee on Vehicle Performance prepare Draft Regulations on motorcycle wheels and rims.*

92. The Committee was also informed that tubeless tyres which have recently become available have safety benefits. Tubeless tyre standards have been drafted in the United States, Japan and Europe. There is a need to adopt an appropriate standard in Australia.

- Layout of Controls and Displays

93. A number of examples were cited of accidents occurring when riders changed to motorcycles with unfamiliar controls. To avoid this occurrence Section 18 of the Draft Regulations was introduced to standardise the layout of controls and displays. The Regulation is equivalent to Federal Motor Vehicle Safety Standard 123 (FMVSS 123) and most motorcycles imported into Australia would meet the latter requirement. Few States in Australia have adopted this requirement and the Committee recommends that:

- *the States and Territories consider adopting Section 18 of the Draft Regulations.*

94. Mopeds are discussed in Chapter 5. The Committee wishes to note that requirements for mopeds and other light vehicles may differ from those provided in Section 18 of the Draft Regulations.

- Visibility and Lighting

95. Accident studies and researchers throughout the world have shown that a major cause of motorcycle accidents is the failure of a motorist to see and respond to a motorcycle in time to avoid an accident. Evidence on this phenomenon includes inferences drawn from statistical analyses of accidents, statements by drivers and police investigations. Typical of the conclusions drawn is that the motorcyclist was technically free of fault in the majority of accidents in which low visibility played a part and that many drivers either did not notice the motorcycle or chose consciously or unconsciously to ignore its existence.

96. Other factors contributing to the lack of visibility of motorcycles include the lack of physical bulk of a motorcycle, dark or inconspicuous clothing worn by riders and the fact that motorcycles represent only 4% of the vehicle population.

97. The Committee was told that the apparent lack of concern by some drivers for the motorcyclist has given rise to a belief by some riders that many of the actions of the driver are deliberate.

98. Evidence received therefore contained numerous suggestions that a strong educational program for drivers and riders alike is needed to break this thinking. Further comment on this aspect is made in ensuing sections of this Report.

99. There are other actions that can improve the visibility of the motorcyclist, the more important of which include increasing the visibility and frontal area of the motorcycle, increasing the visibility of the rider and encouraging or requiring riders to use headlights during the daytime.

100. An assessment of the influence of visibility of motorcycles in traffic accidents has recently been undertaken in Australia by Mr Williams.[1] His findings confirm the important role ascribed to this factor by many researchers in the field.

101. This study of 1508 fatal and injury producing motorcycle accidents reported to Victorian Police in 1974 estimated that a successful measure designed to improve daytime visibility of motorcycles should eliminate about 10% of motorcycle accidents. Williams and Hoffmann[2], in an evaluation of devices designed to increase motorcycle visibility, found that in descending order of detectability the most effective devices were the use of:

. high beam headlamps,
. low beam headlamps,
. white wind fairings, and
. fluorescent riding jacket.

102. Daytime use of low beam headlamps is compulsory in a number of States in the United States. Studies reviewing the effect of such legislation and the voluntary daytime headlamp usage on accidents in New South Wales have shown that while low beam usage reduces the likelihood of certain types of accidents it does not solve the problem of insufficient motorcycle visibility. A successful countermeasure should eliminate about 10% of motorcycle accidents; a result which has not been achieved by compulsory daytime low beam headlamp usage.[3]

103. High beam headlamp usage provides a more intense visual cue than does a low beam headlamp and is the most promising countermeasure. It combines the advantages of low beam headlamp

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1 M.J. Williams, 'The Importance of Motorcycle Visibility in Accident Causation', *Motorcycles and Safety Symposium.*

2 M.J. Williams and E.R. Hoffmann, *Improvement of Frontal Conspicuity of Motorcycles*, Department of Mechanical Engineering, University of Melbourne, December 1976.

3 Evidence, p. 503.

usage with ease of implementation, enforcement and similar cost. Its principal disadvantage is that motorists may be irritated by glare but this effect may be the very feature needed to ensure detection of the vehicle.[1]

104. Riding with headlamps switched on means that taillamps are also lighted. Any effect on crashes from this feature could be presumed to be restricted to crashes where a motorcycle was struck in the rear. This form of motorcycle crash is not frequent.

105. Some motorcyclists object to mandatory daytime headlamp usage on motorcycles. It was claimed that there would be technical difficulties associated with globe and battery failures for some models of motorcycle if they had to comply with daytime headlamp usage. It was also claimed that riders would be subject to fines and that such a requirement relieves drivers of their responsibilities to be aware of motorcyclists. A further difficulty is that, if such a requirement was introduced in respect of new machines, riders on machines with electrical systems unable to cope with the demands of daytime headlamp usage may be placed at greater risk.

106. These objections have raised a number of significant areas of concern requiring further investigation. They relate mainly to technical problems, however, which should be capable of solution. The Committee considers that it would be unfortunate if the bulk of motorcyclists were denied the benefit of this countermeasure and that implementation of this measure through administrative action or requirements in respect of motorcycle design seems justified. The Committee notes that a recent study[2] of survival rates for Australian vehicles indicates that the six year life expectancy of a motorcycle is substantially

1 Evidence, p. 506.

2 M.R. Wigan and T. Thoresen, *Characteristics of the Motorcycle Population in Use in Australia, and the Rate of Effect of Design Change*, Australian Road Research Board, Internal Report, AIR 812-1, November 1977.

shorter than for other classes of motor vehicle and that Australian Design Rules, Draft Regulations and normal competitive marketing of safety innovations will substantially affect the characteristics of the registered motorcycle population in a relatively short period of time. The study concludes that if design modifications are to be promulgated for safety reasons these should be introduced fairly soon, possibly even before the end of 1978, to have the most effective safety impact. The Committee notes that at least one Japanese motorcycle manufacturer has approached State registration authorities to ask if registration would be permitted if all models of this manufacturer were to be modified by wiring the low headlamp beam to the ignition together with necessary upgrading of the electrical system.

107. The Committee therefore recommends that:

- *the Advisory Committee on Safety in Vehicle Design urgently introduce a design rule requiring a motorcycle's headlamp to be on when the ignition switch is on;*

and

- *the Advisory Committee on Road User Performance and Traffic Codes include a requirement in the National Road Traffic Code for mandatory headlamp usage.*

108. Legislation will be required in this area if 100% usage is to be approached. In 1974 the Department of Transport ran a radio campaign encouraging motorcyclists to 'switch on'. Evaluations of such voluntary compliance found some success, but the proportion of headlamps on after the publicity was less than 20% although much higher figures of between 35-50% have been observed.[1]

109. There is at present no design rule requirement for motorcycle lighting. Motorcycle lighting standards are available in the United States and Europe (see Appendix 11). In view of

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1 Evidence, p. 2138.

the motorcyclist's frequent inconspicuity and the Committee's previous recommendations in relation to motorcycle headlamp usage, the Advisory Committee on Safety in Vehicle Design may need to give particular attention to this area. The Committee's recommendation in paragraph 62 has already referred to the need to keep under review the extent to which overseas design requirements should be included in Australian requirements.

110. The wearing of fluorescent jackets has not been well supported by motorcyclists and has been shown to be not as effective as headlamp usage. Day-glo headlamp covers are also on the market, but their usage is minimal and the use of orange to the front is against standard practice relating to the display of lights and colours on vehicles.[1] A current study of fluorescent and reflective jackets and day-glo headlamp covers by Loughborough University in the United Kingdom has uncovered many substantial misapprehensions and unsuitable designs.

111. As a rider's head is the highest point there might be some gains if a rider's helmet could be made more visible. The current Australian Standard[2] for motorcycle helmets AS 1698, does not contain any requirement for helmets to be of a readily visible light colour. However, very few helmets with a black or similar poor visibility colour are produced. The current Australian Standard for helmets also contains a unique requirement for four retro-reflective patches to be positioned on the front, rear and both sides of new helmets produced to the standard. Helmets meeting this requirement, however, have been held up due to a lack of a suitable standard for reflective materials and the need for special care in the selection of adhesives applied to polycarbonate helmets. This situation is obviously unsatisfactory. It is undesirable for a Standard to be promulgated which includes such a requirement without the necessary complimentary Standard to make it achievable.

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1 Evidence, p. 1501.

2 Prepared by the Standards Association of Australia.

112. While evidence[1] indicates that a reflectorised helmet provides only one-tenth the luminance of a reflectorised jacket, the detectability of a rider wearing such equipment is much more rapid than one wearing dark clothing.

113. Devices to increase the detectability of a motorcycle and its rider have not been tested in combination. This is an area where further gains in motorcycle safety could be made. The Committee therefore recommends that:

. *the Commonwealth Department of Transport undertake an assessment of the benefits of combining or extending aids to increase the conspicuity of motorcycles and riders and that these devices be tested in field trials involving actual riding conditions.*

114. Draft Regulations currently require flat rearview mirrors to be fitted on all motor vehicles. It was claimed in relation to passenger cars that flat mirrors restrict the field of view and create blind spots. Australian Design Rule 14, Rear Vision Mirrors, does not require fitment of such mirrors to the passenger side of the vehicle where sufficient rearward vision is provided by the internal rear vision mirror and the external mirror on the driver's side. It is a matter of importance to motorcyclists, in view of the frequent claim by car drivers of motorcycle invisibility, that nearside mirrors be required on motorcars. The Committee recommends that:

. *the Advisory Committee on Safety in Vehicle Design investigate the effect of car blind spots and the use or omission of nearside car mirrors on motorcycle and bicycle visibility, with a view to amending Australian Design Rule 14, Rear Vision Mirrors.*

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1 Evidence, p. 503.

115. In relation to the motorcycle rider's rearward vision it was claimed that, in view of the variability of the head position of motorcyclists in active driving, flat mirrors have a severely debilitating effect on the use that can be drawn from such mirrors. It was claimed that motorcycle mirrors are more prone to vibration and that this restricts the depth perception achievable from flat mirrors. Field of view is restricted to an unsafe degree by flat mirrors and convex mirrors, it was claimed, would allow a wider field of view. In view of these criticisms by riders the Committee recommends that:

- *the Draft Regulation covering the use of flat mirrors for rearward vision be reviewed by the Advisory Committee on Vehicle Performance to permit the use of convex mirrors;*

and

- *in view of the firm convictions of riders favouring headlamp usage and convex mirrors, rider representatives be invited to participate in the deliberations of the Advisory Committees on Safety in Vehicle Design, on Vehicle Performance and on Road User Performance and Traffic Codes.*

- In Use Aspects

116. The Committee heard further argument in evidence on the case for compulsory inspection of motorcycles. Compulsory vehicle inspection has been the subject of continuous discussion for many years and extensive comment on this matter has been made in previous Reports of the Committee on *Passenger Motor Vehicle Safety* and on *Heavy Vehicle Safety*.

117. The Committee, however, has again been faced with the problem of lack of reliable data to establish the relationship between accidents and vehicle defects caused by poor maintenance.

Numerous witnesses pointed to the need for annual vehicle inspections while others considered that such inspections were too infrequent and would not be a cost-effective way of improving motorcycle safety. Accident studies indicate that roadworthiness of a motorcycle does not appear to be an important source of accident causation.

118. The Australian Capital Territory, Northern Territory and New South Wales are the only areas requiring an annual inspection on re-registering a motorcycle. Other States rely on random checks for roadworthiness and on the issue of roadworthiness certificates on change of ownership. Evidence indicates that such inspection schemes can be abused and ineffective. It was claimed that certificates have been issued without inspection of the motorcycle and that those responsible for the issue of such certificates are often insufficiently familar with motorcycles to adequately check these machines.

119. Evidence indicates that motorcycles need regular maintenance and that a significant proportion of owners are enthusiasts capable of doing their own service work. Motorcycle dealers indicated that a very low proportion of motorcycles sold are returned to their mechanics for servicing. The Committee notes that in an endeavour to encourage owners to have their machines checked and serviced regularly by qualified mechanics, Yamaha dealers have had free service clinics. The cost of maintenance of a motorcycle compared to other motor vehicles is low.

120. The Committee supports the view that compulsory inspection schemes will contribute to the safety and efficiency of motorcycles and recommends that:

- *compulsory motorcycle inspection be required prior to re-registration or transfer of ownership.*

Rider Primary Safety

- Rider Training

121. Rider training was one of the measures most strongly supported by witnesses, in particular those representing motorcycle clubs, road safety councils and the Police. Inexperience of riders particularly those in their first two years appears to be a major contributing factor in rider accidents (see paragraphs 22-27). While 70% of motorcycle-motor vehicle accidents are the fault of the motor vehicle driver, rider inexperience, in these accidents as well as accidents where the rider is at fault, is often a significant factor. Witnesses strongly advocated that riders be trained in accident avoidance techniques, to provide them with the skills to avoid dangerous situations, to escape from an accident situation, and to reduce the possibility of injury.

122. Training courses brought to the notice of the Committee are outlined in Appendix 12. Those involved in training riders include the Police, road safety councils, motorcycle clubs, Military Police Schools and motorcycle distributors. In addition there are State government aided programs for student driver education.

123. Distributors claimed that they have had difficulty in running their own programs and they now assist training organisations by supplying motorcycles and training materials. Training programs organised through clubs and road safety councils often depend on voluntary assistance from experienced riders to act as instructors.

124. Only a small proportion of newly licensed riders, however, receive formal training. In New South Wales the Traffic Accident Research Unit stated that about 1% of riders received some training prior to receiving their licence. Similarly the Queensland Road Safety Council stated that they would be training a maximum of 2.9% of those registering motorcycles.

125. In Australia little work has been done on evaluating the effect of such training programs on the incidence of accidents and the Committee is concerned that in common with the wider area of driver training there appears to be no conclusive evidence that such schemes reduce accidents. Studies which have highlighted rider inexperience as a contributory factor in accidents demonstrate the urgent need to assess the effectiveness of rider training schemes.

126. Intuitively, and correctly the Committee believes, many witnesses have stated that the introduction of rider training programs is the appropriate approach to the problem of rider inexperience. While supporting this view the Committee considers that there would be considerable value in first determining the influence of training programs on riders subsequent accident involvement and driving performance. It therefore recommends that:

. *the Commonwealth Department of Transport sponsor and assist in the development and subsequent evaluation of pilot rider training and testing programs.*

- Licensing

127. A licence gives the rider legal access to Australia's public roads and is thus an important control in road safety. Riders face high risks of becoming a road accident statistic. The scope to limit this risk through appropriate licensing restrictions is a matter on which many suggestions were received and to which particular attention has been given.

128. Studies indicate that high motorcycle accident probability is associated with motorcycles with an engine capacity above 250 cc, with riders aged 25 years or less and with riders having less than 2 years riding experience.

129. In view of the over-involvement of young male riders and high engine capacity motorcycles in accidents, numerous witnesses expressed concern with the ready accessibility of young riders to high powered machines. Western Australia, Queensland and New South Wales have used different licensing schemes in an attempt to restrict access of inexperienced riders to machines with high engine capacity. The Western Australian and Queensland licensing schemes provide that a motorcyclist cannot ride a motorcycle exceeding 250 cc capacity where the licence test is undertaken on a motorcycle below this size. These schemes, however, do not restrict riders to low capacity machines where their licence test is taken on a motorcycle exceeding 250 cc capacity. An evaluation of the Western Australian scheme showed inconclusive results due to too few subjects being used. However, the New South Wales graded licensing scheme introduced on 1 January 1977 does restrict riders to a motorcycle under 250 cc in the first 12 months of being licensed. This scheme is being evaluated. Accident involvement of young riders is a matter of concern and graded licensing of the rider to low capacity machines may be an effective measure. However, these schemes are only recent and it is important to await the evaluation of the New South Wales scheme before other States examine its applicability to their own State.

130. In view of the over-involvement of high capacity motorcycles in accidents it was proposed to a number of witnesses that there be a ban on high capacity motorcycles. High engine capacity motorcycles with their larger size and weight make them more difficult to handle for some riders. Engine capacity is not to be equated, however, with the power and speed of a motorcycle as some smaller capacity machines are capable of very high speeds. Larger capacity motorcycles are used more for touring as they are frequently quieter, more docile and not as high reving. As previously indicated, inexperience appears to be more the problem and this may be effectively reduced by restricting riders to low

capacity motorcycles in the first 1 to 2 years of riding. The Committee considers that a moped as a 'first' two-wheeler may also increase the rider's experience before he gains a motorcycle licence. This point is discussed further in Chapter 5.

131. Many witnesses criticised the licensing requirements for riders and drivers throughout Australia for not being stringent enough. Witnesses referred to the ease with which rider learner permits were obtained; to the lack of pre-licence training by newly licensed riders; and to the low standard of rider and driver licence testing. It was pointed out that, as the majority of accidents involving a car and a motorcycle are caused by the driver, truly effective means of reducing the motorcycle accident rate must include licensing standards for car drivers. The committee therefore recommends that:

. *model testing procedures and standards for rider and driver licence applicants be developed by the Commonwealth Department of Transport.*

132. Witnesses also suggested that some riders and drivers who lost licences through driving offences were able to continue driving by having a new licence issued to them. The New South Wales Department of Motor Transport stated that New South Wales operates a system for detecting this offence and that this system involves other departments with unofficial liaison between both State and Commonwealth government departments. The Committee commends this co-operative effort.

133. A report recently brought to the Committee's attention is *Driver Licence and Driver Improvement Programs - A National Review* which was prepared by Mr R.S. Coppin, a consultant to the Commonwealth Department of Transport, and published in September 1977. This report was not restricted to motorcycle licences but looked at the whole area of driver licensing and

driver improvement programs. Some parts of the report have particular relevance to riders and its recommendations regarding motorcycle riders are attached at Appendix 13. The Committee commends this report as worthy of study and evaluation.

- Publicity

134. Many witnesses suggested that there was an urgent need for safety related publicity campaigns to be directed at both riders and drivers. Campaign proposals directed to drivers, it was suggested, should aim to improve driver attitudes to other road users and to make them aware of the existence of riders. The Committee was told that the apparent lack of concern by some drivers for motorcyclists has given rise to a belief by some riders that many of the actions of drivers are deliberate.

135. Publicity directed at riders, it was claimed, should endeavour to educate riders on their need to be seen, on defensive riding techniques that they can use on the road and on the benefits and need for protective clothing.

136. There is considerable value in these suggestions. Campaigns aimed at particular hazardous situations or practices would be a useful means of improving rider safety.

137. Such campaigns may need to involve a number of channels of communication as riders and drivers are spread throughout the community and may be difficult to contact via any one medium. Therefore publicity campaigns need to be carefully developed, implemented and evaluated in order to determine their cost effectiveness and their capacity for accident reduction.

138. The Committee recommends that:

. *the Publicity Advisory Committee on Education in Road Safety develop and evaluate a range of publicity campaigns relating to motorcycle safety; and*

. *consideration be given to including rider representation in the development of the publicity campaign.*

- Alcohol and Drugs

139. Several studies and investigations by State authorities have found that alcohol is a problem of the rider as well as motor vehicle drivers.

140. Blood alcohol tests taken during post-mortem examinations of motorcycle riders have been reported on in 6 Australian studies, shown in Table 12. Approximately 1100 riders were killed in the various regions during the relevant periods covered by these studies. Of these fatalities 39% were tested for the presence of blood alcohol and a non-zero reading was obtained in 35% of cases.

141. Table 13 shows blood alcohol levels of riders killed in 5 of the studies. The blood alcohol levels attained by the dead riders who were affected by alcohol were remarkably high. Ninety-two per cent were above 0.05 gm/100 ml, while 53% were in excess of 0.15 gm/100 ml.

142. At a broader level involving both fatal and injury producing accidents the study by Williams of 1508 motorcycle accidents in Victoria in 1974 found that alcohol was present in at least 12% of these accidents. Of these the rider alone had been drinking in 74%; the other driver in 17%; a pedestrian in 4%; while both the rider and driver were affected in 5%. These data, however, provide only a lower limit to the extent of alcohol consumption[1] as it was limited to those who were sufficiently injured to cause hospitalisation.[2] In fact few car drivers in any of the 1508 accidents studied required hospital attention and drinking drivers may remain undetected and therefore under-represented in the above figures.

1 Evidence, p. 477.

2 In April 1974, it became compulsory in Victoria for persons admitted to a hospital casualty ward to furnish blood for testing.

TABLE 12

DETECTION OF ALCOHOL USE AMONGST 426 KILLED RIDERS

Study	Place	Period	Riders Killed (n)	Riders Tested (n)	Testing Rate (%)	Positive Alcohol	
						n	%
Smith	Perth WA	1950-1973	approx. 429	173	approx. 40	63	36
WAGCL (1973)	WA	1973	24	19	79	6	32
WAGCL (1974)	WA	1974	43	29	67	20	69
Tonge (1972)	Brisbane Qld	1955-1971	approx. 451	94	approx. 21	34	36
Hossack, et al. (1974)	Vic.	Jan. 1972-Jun. 1973	84	52	62	9	17
Williams	Vic.	1974	65	59	91	18	31
		TOTALS	approx. 1096	426	approx. 39%	150	35%

Source: Evidence, p. 482.

TABLE 13

BLOOD ALCOHOL LEVELS FOUND IN 253 KILLED MOTORCYCLE RIDERS

STUDY	Blood Alcohol Concentration (gm/100 ml)							Sum
	NIL	.000 to .049	.050 to .099	.100 to .149	.150 to .199	.200 to .249	.250 to .299	
WAGCL (1973)	13	2	1	0	2	1	0	19
WAGCL (1974)	9	0	3	5	7	3	2	29
Tonge (1972)	60	2	5	8	9	9	1	94
Hossack, et al. (1974)	41	2	0	4	0	3	0	52
Williams	41	1	5	1	7	3	1	59
Sum	164	7	14	18	25	19	4	253

Source: Evidence, p. 483.

143. The study by Williams reached a number of conclusions. Consumption of alcohol is an important factor in motorcycle accidents, particularly fatal accidents. Alcohol affected riders are significantly over involved in fatal and single vehicle accidents. They are predominantly younger than 25 years of age, and blood alcohol levels attained are typical of those found in problem drinkers. Significantly fewer motorcycle riders killed are affected by alcohol than car drivers killed. However, the levels of blood alcohol attained in comparable groups of riders and drivers are similar.

144. These findings contradict the widespread belief expressed to the Committee that it is impossible for a rider even to begin to operate a motorcycle when affected by alcohol. It is apparent, however, that riding ability is seriously impaired by the ingestion of alcohol and this was supported by the finding that alcohol affected riders were significantly over-represented in single vehicle accidents.[1]

145. Little evidence was received on the presence of other drugs in riders. Appropriate means for measuring drug intake have not been developed as has been done in the case of alcohol.

146. There appears to be far less known about drinking riders than drinking drivers and in view of the social importance of drug and alcohol usage their effect on drivers and riders will form part of the Committee's future inquiries on the human aspect of road safety.

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1. Evidence, p. 487.

- Rider and Driver Vision

147. Expert witnesses placed differing emphasis and interpretation on the significance of driver vision as a cause of accidents. While surveys may detect optical defects in many drivers, the relationship between such defects and driving performance has not be demonstrated. Studies conducted indicate that visual defects are a very minor cause of accidents.

148. The Australian College of Ophthalmologists submitted that only 1% of traffic accidents in a New South Wales survey were shown to be caused by physical and visual defects. The College also suggested that if vision defects were a significant cause of accidents then it would be expected that colour vision which is defective in 8% of the male population would assume a higher percentage than 1% of causes of traffic accidents.[1] Evidence relating to the failure of motorists to see and respond to a motorcycle in time to avoid an accident has been discussed in earlier sections of this Report. That evidence indicates that there is a problem of perception of a motorcycle by other road users rather than of visual defects in drivers.

149. There are various problems with goggles and visors used by riders to protect their eyes and faces. These problems include scratching of visors and goggles, darkly tinted visors restricting night vision, and coloured visors which change the colours of objects such as traffic lights.

150. Australian Standard 1609 (AS 1609) on Automotive Eye Protection contains requirements for impact resistance and luminous transmittances of at least 85% which means that only clear visors meet the requirement. While members of the Standards Association committee considered tinted lenses to be quite unsafe for night riding it was considered that they could be satisfactory for day riding. However, as it was considered that as many riders would not change from tinted to clear visors at night, it was decided not to include tinted visors within AS 1609.

1 Evidence, p. 1506.

151. Helmets produced to AS 1698, Helmets for Vehicle Users, if manufactured with visors are required to comply with AS 1609. The majority of visors, however, are sold separately to helmets and these visors do not comply with AS 1609. While aware that many riders strongly favour the use of tinted visors for day riding the Committee considers that relevant authorities should give consideration to requiring that all visors comply with AS 1609. It therefore recommends that:

- *the Commonwealth Department of Business and Consumer Affairs and relevant State authorities give consideration to requiring that eye protection equipment sold to riders comply with the requirements of Australian Standard 1609, Automotive Eye Protection.*

152. Polycarbonate, which is the material from which visors and goggles are mostly manufacturered, is subject to scratching. The Committee is aware that a surface treatment to reduce susceptibility to scratching is applied to industrial safety spectacles. Witnesses claimed that visors become dangerously scratched within a short time and have to be replaced. One witness suggested that AS 1609 should contain criteria relating to anti-scratching properties. The Committee finds merit in this suggestion and recommends that:

- *the Standards Association of Australia give consideration to the inclusion of anti-scratching requirements within Australian Standard 1609, Automotive Eye Protection.*

153. When helmets are manufactured using polycarbonate the SAA requires under AS 1698 that a warning label or brochure be provided indicating that a serious loss of strength can be expected if the material comes in contact with hydrocarbons which include fuels, lubricants, certain paints, cleaning materials and adhesives. The Committee was informed that visors manufactured from polycarbonate are not supplied with a similar warning. It therefore recommends that:

. *as visors are often manufactured from polycarbonate the Standards Association of Australia include in Australian Standard 1609 a requirement for an informative brochure or label to be provided specifying safe cleaning materials and containing a warning on deleterious effects of hydrocarbons.*

- Actions of Other Road Users

154. Some motorists and pedestrians undertake hazardous manoeuvres in front of riders which are often the cause of subsequent collisions. Possible reasons are that drivers and pedestrians do not see and are therefore not aware of the rider's presence, or that they may see the rider but misjudge his position and approaching speed. Some witnesses suggested that motorists may see a rider but still undertake a manoeuvre known to be hazardous. The status of two-wheeled vehicles on the road, it was suggested, might not be very high in the minds of some motorists and there is an urgent need to stress to other road users that the motorcycle and bicycle have an equal right to use the road. These matters could be made the subject of publicity campaigns.

155. In some States riders with pillion passengers are restricted to a speed limit lower than other road users: User groups argued that motorcycles are designed to carry pillion passengers safely and that differential speed limits place them at greater risk of being involved in an accident or being forced from the road by other road vehicles moving at higher speeds. No evidence was received in support of the existing speed restriction on riders with pillion passengers. The Committee therefore recommends that:

. *relevant State authorities re-examine the need to retain differential speed restrictions on motorcycle riders with pillion passengers in view of the alleged additional risks involved when such vehicles are restricted to a lower speed than other traffic.*

156. The Committee is aware of the restrictions on the speeds of learner drivers and provisional licencees in some States but did not receive any evidence on their speed limits.

Road and Environmental Aspects

157. The stability of a motorcycle being a two-wheeled vehicle is dependent on the balance exerted by the rider and on road surface conditions. The rider is more vulnerable to the environment than is the driver of vehicles with four wheels.

158. Witnesses pointed to a range of road surfaces dangerous to a rider. These included loose gravel, pot holes, the accumulation of oil drips on the road way, polished bitumen due to continual tyre contact, tram and train lines, uncoated steel expansion plates on bridges, metal manhole covers, painted arrows, zigzags and pedestrian crossings, as well as median kerbs and traffic domes. It was claimed that a loss of tyre adhesion on these surfaces can have disastrous results particularly when they are wet or occur where the rider has to turn or brake.

159. Suggestions to overcome road surface problems include the use of non-skid materials. Materials suggested included paint mixed with a grit of silicon carbide or similar substance to give it a non-skid surface and substances such as gravel which can be rolled into the bitumen surface.

160. It was claimed that riders who ride to the left or right of a lane to avoid painted road markings or slippery sections of the road affected by the accumulation of oil drips endanger themselves by being in the blind spot of the preceeding driver. Riders may also face a risk of slipping on 'polished' sections of bitumen arising from continual tyre contact and wear, particularly if it is wet.

161. The Committee recommends that:

. *the National Association of Australian State Road Authorities sponsor further research to:*
   (a) determine safe road marking materials,
   (b) assess the importance of the road surface to the motorcycle, and
   (c) reduce the 'slip' factor of certain road surfaces.

162. Roadside furniture is part of the environment which a rider faces in the event of becoming involved in or attempting to avoid an accident. The rider receives little protection from his vehicle in collisions with square gutter kerbing, traffic or street light poles, street signs, trees, fences or guide posts.

163. An item of roadside furniture particularly dangerous to riders is the ARMCO fencing alongside roadways designed to prevent vehicles leaving the roadway by deflecting them off the fencing. In this situation the secondary safety features of a car usually protect the driver. The motorcycle, however, is usually stopped abruptly and the rider can bounce or slide off the ARMCO barrier, possibly back into traffic. The motorcycle needs distance to decelerate and/or recover. An immovable barrier is dangerous for the rider. Riders would like to see future highways designed to cater for such problems.

164. The Committee recommends that:

. *road planning and construction authorities consider the differing safety requirements of motorcycles and other motor vehicles in future road construction and placement of road furniture.*

Rider Secondary Safety

- Helmets

165. The level of head protection afforded by the use of crash helmets has through advances in design and technology been steadily improved. Standards for the design, strength and construction of helmets prepared in a number of countries have been progressively superseded by standards offering improved protection.

166. Australian helmet standards have been introduced and subsequently amended by effectively endorsing the most competent overseas standards available. The Standards Association of Australia (SAA) may modify these standards slightly to meet Australian conditions.

167. The first Australian Standards for helmets, E 33 (1959) and E 43 (1968) were based on British Standards issued in 1956 and 1960 for motorcyclists and racing motorcyclists respectively. These standards were superseded[1] in 1974 by Australian Standard 1698[2] (AS 1698); a composite standard intended for all vehicle users, including car drivers and racing motorcyclists. Australian Standard 1698 is approximately equivalent to two United States standards but with additional requirements for flammability and conspicuity. There is also a requirement for helmets approved to AS 1698 to be branded with the words 'Vehicle User's Helmet' in order to exert control over sales.

168. The SAA stated that a new international standard on motorcycle helmets currently being prepared is likely to be adopted as an Australian Standard. This standard, being prepared by the International Standards Organisation (ISO), is expected to be about 50% better[3] than AS 1698.

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1 Australian Standard E 33 (1959), Protective Helmets for Motorcyclists, and E 43 (1968), Protective Helmets for Racing Motorcyclists, were withdrawn by SAA in April 1976.

2 Australian Standard 1698-1974, Protective Helmets for Vehicle Users.

3 Measured in terms of impact energy.

169. A comparison of performance requirements for various Australian, British, ISO and United States motorcycle helmet standards is shown at Appendix 14.

170. Evidence was received on a number of problems experienced over recent years relating to the testing, review, implementation and compliance to helmet standards.

171. By the early 1970's use of helmets by riders and pillion passengers had become compulsory throughout Australia and for practical reasons the type of helmet required to be worn included all those purporting to comply with a recognised standard. A number of these helmets, however, were known to differ considerably in protective capacity and, in respect of some helmets, forged markings indicating compliance to a standard were found to be applied to some helmets.

172. On introduction of AS 1698 action was taken in relation to these problems. Legislation calling up AS 1698 under road traffic acts and/or consumer protection laws was enacted in New South Wales, Victoria, Queensland, South Australia and Western Australia, and since October 1975 Customs regulations have specified that no helmet shall be permitted entry into Australia unless it complies with AS 1698. The SAA advised that Commonwealth action in relation to the sale of unsafe helmets is being considered under Section 62 of the Trade Practices Act.[1]

173. There have been technical difficulties in demonstrating compliance with AS 1698. The standard contains a requirement for reflective material[2] to be applied to helmets for night

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1 Section 62 prohibits the supply of unsafe goods in respect of which a notice has been published by the Minister declaring them to be an unsafe good. Companies or persons in breach of this Section of the Trade Practices Act are liable to criminal prosecution as well as injunction, damages and ancillary orders by the court.

2 This reflective material is required to comply with AS 1906, Retroreflective Materials and Devices for Road Traffic Control Purposes: Part 1, Retroreflective Materials.

visibility, yet no complementary standard for this reflective material has yet been agreed upon and published. Helmet testing agencies therefore issue helmet testing reports noting non-compliance of helmets with AS 1698 on these grounds. Moreover, as many of the technical requirements of AS 1698 have inadequately specified terms for compliance or acceptance, there are difficulties in supplying proper test reports on helmets. Considerable delays have also been experienced by some importing organisations in securing recognition of compliance by helmets with AS 1698.

174. The SAA stated that there were a number of 'grey' areas under AS 1698 that should be reviewed.[1] They considered, however, that in view of the intention to adopt the draft ISO helmet standard which should be completed in 1978 there is insufficient time to amend and improve the present standard, AS 1698. Other witnesses did not share this view and claimed that AS 1698 should be reviewed as soon as possible. Two such areas are the lack of impact resistance testing to the protective shell covering the mouth and jaw of full-face helmets and the lack of any safety requirements for shields or peaks used on helmets for the protection of the eyes against the sun.

175. It is considered that AS 1698 should be reviewed and improved as soon as possible as there could be delays and further problems inherent in waiting for the ISO helmet standard. The Committee therefore recommends that:

- *the Standards Association of Australia helmet committee review Australian Standard 1698, Protective Helmets for Vehicle Users, as soon as possible and that the review process seek to include the views of user, importing and manufacturing groups.*

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1 Evidence, p. 1735.

176. Witnesses agreed that helmets should fit well but disagreed on the number of sizes needed. Australian Standard 1698 includes four sizes of test headforms but makes no reference to the sizes of helmets which are to be provided. An increased number of sizes would result in increased costs to the consumer. The SAA submitted that the draft ISO standard on headforms provides for 16 sizes and requires that the range of sizes manufacturers are to provide for testing will include at least seven of these sizes. If the ISO standard is adopted at least seven sizes of helmet will be required in Australia.

177. Witnesses expressed concern at the prohibition of imported helmets not complying to AS 1698. Some helmets manufactured overseas have been approved to standards higher than AS 1698. These helmets are expensive and have only a small market potential, and manufacturers and importers are reluctant to enter into the expense and procedure involved in having these helmets approved to AS 1698. This factor together with delays in approval to AS 1698, it was claimed, are effectively denying the rider the right to buy the best safety helmet available, particularly for those involved in racing.

178. The Auto Cycle Council of Australia (ACCA) and constituent Autocycle Unions require competitors to wear a helmet offering a high degree of protection in motorcycle sports events where speed is the determining factor. While AS 1698 offers satisfactory protection for a normal commuting motorcycle rider it may not offer the protection desirable for competing motorcyclists whose speeds at times exceed 240 km/h.[1] The ACCA feels that some helmets approved to AS 1698 are acceptable for racing but there are other helmets approved to the standard which are not acceptable for racing. Helmets produced to just pass the requirements of AS 1698, it was claimed, would be unable to provide the protection required under racing conditions. The ACCA therefore suggested that there should be a return to the former situation of separate standards drafted for road and racing use.

1 Evidence, p. 1665.

179. Because AS 1698 does not adequately cover the safety needs of all categories of helmet usage there is a need for more than one helmet standard. The Committee notes that helmets are increasingly being designed according to intended use such as road racing, commuting and touring, trials, motorcross, trails and drag racing. Legislative and regulative requirements based on one helmet standard could restrict the availability of helmets suited to particular uses offering advances in design and protection.

180. As the majority of helmets are imported the requirement that imported helmets comply with AS 1698 may be unduly restrictive. The Committee recommends that:

. *the Minister for Business and Consumer Affairs allow import entry to protective helmets particularly suited to speciality uses.*

181. In order that riders may obtain safety helmets designed for particular uses and constructed to an appropriate standard the Committee recommends that:

. *the Standards Association of Australia consider the need for separate standards on protective helmets suitable for use in an appropriate range of uses. Alternatively, the same purpose could be achieved by defining appropriate helmet categories, with appropriate testing requirements within an updated Australian Standard 1698.*

182. Difficulties have been experienced in gaining import entry of sample helmets for purposes of demonstrating compliance to AS 1698 through testing. The Committee recommends that:

. *Customs Regulations be appropriately amended to allow import entry of helmets to be tested for compliance to Australian Standard 1698.*

183. The compliance of helmets to AS 1698 is required for all imported helmets and by the States. However, helmets designed to comply with standards prior to AS 1698 are still being sold and used, some of them complying with standards up to 20 years old. While a period of grace for clearance of stock before enforcement under the law may be required the safety of riders is virtually being ignored by not informing riders that certain standards are now unacceptable. A 2 year period of grace on banning the sale of helmets not to AS 1698 in New South Wales will finish in October 1978.

184. The Committee recommends that:

- *the Advisory Committee on Road User Performance and Traffic Codes examine appropriate solutions to the problem of helmet sales which comply to superseded helmet standards or for which approval to Australian Standard 1698 has been withdrawn subsequent to marking.*

185. There is also a need for in-use monitoring of the effectiveness of helmets and of their compliance to the relevant standard. A number of witnesses submitted that there is considerable value in conducting inspection and analysis of helmets after they have been involved in accidents. The Committee recommends that:

- *the Commonwealth Department of Transport introduce a system of post-accident analysis of motorcyclists' helmets;*

and

- *compliance to Australian Standard 1698 of helmets available in the marketplace be monitored by a government sponsored independent testing agency and that the results be widely disseminated.*

186. Studies indicate that helmets have significantly reduced the incidence of fatal head injuries and that full-face helmets provide significantly greater protection against facial injury than do jet style helmets worn by riders and pillion passengers.

Dr Yeo, Director of the Spinal Unit, Royal North Shore Hospital, suggested that there may be a relationship between the location of spinal injury and the type of helmet worn.

187. Dr Yeo conducted a review of 20 patients suffering from serious spinal cord injury following motorcycle accidents. He found that those with cervical spinal injuries had most often worn jet type helmets and those with thoracic and lumber injuries had most often worn full-face helmets. The study suggested that jet type helmets may not protect riders from cervical spinal injury as well as the full-face type. Further examination of Dr Yeo's data and some additional information by the Traffic Accident Research Unit (TARU) in New South Wales has shown the results are not statistically significant.

188. Evidence was sought from the Snell Memorial Foundation, Inc., in the United States, to determine whether there was any support for Dr Yeo's hypothesis to be drawn from analysis of overseas motorcycle accidents. Dr Snively of the Foundation found no support for the hypothesis following retrospective review of 2 studies each involving over 600 patients.

189. The number of serious spinal injuries among motorcyclists occurring each year is small. Nevertheless, bearing in mind the traumatic outcome for patients who usually suffer permanent paralysis, further work must be done to determine the validity of Dr Yeo's suggestion. In order to reach a definite conclusion regarding Dr Yeo's proposals, the Committee recommends that:

- *responsible organisations support Dr Yeo's proposals for collection of relevant information from spinal units throughout Australia and for a joint study by the Traffic Accident Research Unit in New South Wales and Dr Yeo into the relationship of helmet type and spinal cord injury.*

- Other Protective Clothing

190. The protective role of helmets, visors and goggles has been discussed in earlier sections. Protection of the rest of the body through other items of protective clothing is also important. As yet there are no Australian Standards for any items of protective clothing other than helmets and visors.

191. Studies have indicated that in fatal motorcycle accidents the majority die from serious head and/or serious torso injury. Of those surviving motorcycle accidents, injuries are confined mainly to severe local injuries to the arms and particularly to the legs.

192. The ACCA have strict safety guidelines on the standard and condition of the racing rider's protective clothing. The main item is the racing rider's 'leathers', a one piece jump-suit made of leather covering the entire body except for the hands, feet and head. It is tailor-made so that its tight fit gives added rigidity and strength to the rider's bones as well as protection from abrasions, cuts and internal injuries. However, at speeds over 190 km/h leather suits are no longer capable of offering enough protection and a new fabric is being developed in America which is suitable for road racing.

193. Witnesses advocated that riders and their pillion passengers wear protective clothing, even in hot climates. Evidence from Australia Post indicates that injuries amongst their riders are estimated to be 10% more severe in tropical areas of Australia. Good leather gloves and boots or good fitting full cover shoes, leather jacket and possibly leather pants or leggings are also considered necessary. Even at a cost of $200 to $300 for protective clothing it is still cheap protection.

194. Helmets are the only item of protective equipment demonstrated by accident studies to be truly effective. Protective equipment such as gloves, boots and rider clothing while offering some protection, it was suggested, have been found to be effective only against minor injuries.[1] It has been further suggested that at present preventing accidents by improving conspicuity of motorcycle riders with the above protective equipment would be more effective than relying on protective clothing to wholly prevent injury.

195. Research into conspicuity of the motorcycle and rider has shown that in the daytime the luminance of a fluorescent jacket is only slightly below that of a low beam headlamp, and that a reflectorised helmet had only one tenth of the daytime luminance of a fluorescent jacket.[2] A high visibility jacket has been shown then to increase the luminance contrast between the rider and his background.

196. Colours apart from black are now available in leather apparel, but at substantial cost. There are also available reflectorised and non-reflectorised synthetic fabrics providing less protection than leather but which add considerably to the conspicuity of the rider and which are more suitable for warm weather.

- Injury Reduction and Vehicle Design

197. Motorcycle design over the years has concentrated on performance and handling properties, while vehicle design to reduce the severity of injuries received in accidents has not similarly progressed. There was evidence in several areas of motorcycle design of attempts to reduce injury resulting from accidents.

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1 Evidence, p. 134.

2 Evidence, pp. 504-7.

198. Integration of primary and secondary safety features in motorcycles requires careful consideration. Secondary safety features can only be useful and effective if they do not reduce the primary safety qualities of the motorcycle which holds the greatest potential for accident avoidance and reduction. These primary safety features relate to a motorcycle's ability to stop and accelerate faster, and to manoeuvre and handle better than a motorcar. It is noted that as motorcycles are not produced in Australia it is difficult for Australian authorities to have any influence on these design considerations.

199. Several witnesses reported on conclusions reached following motorcycle crash tests carried out by the Motor Industry Research Association (MIRA) in England. An obvious conclusion was to smooth out the outer surface of the motorcycle so as to reduce the number of potentially dangerous projections.

200. It was found that fuel tank shape is important as the rupturing of the fuel tank can cause injury to riders, and that fuel filler caps should be flush fitting because riders slide over them in frontal crashes. Fixed tank top luggage racks should be dispensed with because of their potential danger to the rider's crutch.

201. Handlebar design is also important and very high ones such as those fitted to 'chopper'type motorcycles, move into a position where the rider's torso is dragged over them. It constitutes a potential penetrator of abdomen, chest, neck or face.

202. Another area for improvement is the installation of energy absorbing material ahead of the leg but below the handlebars in order to minimise injuries caused by contact with the handlebars. It was found that energy absorbing handlebars with a load capacity below the fracture level of the femur, and removal of projections on the handlebars lessens injuries when the rider is projected forward over the handlebars.

203. Windscreens appear to be vitally involved in crash damage. It was found that the lower the windscreen can be and still function, the better, and a screen that will 'knock off' appears to be the safest.

204. The location of the ignition coil under the fuel tank heightens the danger of fire if the fuel tank or fuel filler ruptures and drenches the coil with fuel. It was suggested that an inertia cutout switch should be fitted.

205. The advantages and disadvantages of crash bars were raised by witnesses. Some witnesses claimed that crash bars can give protection in some instances. Studies by MIRA, however, found that not only were crash bars failing to protect a rider in a crash but they could cause severe damage to riders' legs during head-on collisions when the rider is ejected from the motorcycle. Crash bars tested by MIRA were standard fittings which bent during sliding impacts. They also allowed the footrest to be impacted, fractured and in some cases detached. In side impacts crash bars were found to be useless as they bent and deformed to become flattened against the motorcycle.

206. Doctors and surgeons strongly advocated that crash bars should give protection to the lower leg, particularly the foot.

207. Japanese manufacturers, Yamaha and Honda, have also commenced extensive testing of crash bars. Experimental crash bars developed to date, however, have undesirable effects on stability and manoeuvrability which are important primary safety factors. Tests have not indicated that crash bars would be effective in saving rider injuries in most conditions.

208. Other suggestions to improve rider safety which appear to have considerable merit involve the use of air-bags mounted around the handlebar area and inflatable jackets to be worn by

riders. Preliminary research on air-bags done by MIRA has had promising results. It is likely that air-bags, however, will only provide a partial answer as they are really only useful when a motorcycle hits another vehicle, as opposed to the more frequent situation in which the other vehicle hits the motorcycle.

209. Dr Bothwell of MIRA has invented an inflatable jacket as a derivation of the air-bag concept. In this case the air-bag is on the rider not the machine. The air-bag is built into the jacket with the gas generator and its sensing and triggering equipment is mounted on the motorcycle. The jacket and pack are connected by a hose that the rider plugs in on mounting the motorcycle. The hose is designed to uncouple automatically 40 milliseconds after the start of inflation, so that machine and rider can separate. Tests on dummies have shown that it gives very good protection of the torso, neck and head.