M.R. WIGAN T. THORESEN

THE AGE DISTRIBUTION AND LIFE OF MOTORCYCLES IN AUSTRALIA AND THE IMPLICATIONS FOR DESIGN RULES

ABSTRACT

The factual data on motorcycles and motorcyclists in Australia are not sufficiently broadly based for most forms of assessment, and insufficiently detailed to design and appraise counter-measures with any degree of confidence. This article is concerned with the rate at which design changes introduced for safety or other reasons will spread through the population of vehicles used on the road. A broad statistical context is given which strongly suggests that if design modifications to new motorcycles are to be promulgated for safety reasons, significant penetration of the motorcycle population would follow from their early introduction. The acute lack of reliable detailed Australian statistics on motorcycles and bicycles proved to be an important restriction on the work of Parliamentary Road Safety Committees (e.g. House of Representatives Standing Committee on Road Safety (1978)) and this brief analysis has been carried out to assess the value of a section of the available Australia-wide data relevant to motorcycle safety measures. Socio-economic and demographic issues are not considered in any detail, but should subsequently be given specific attention.

INTRODUCTION

The high incidence and severity of accidents to the present population associated with motorcycle ownership and use has generated a considerable concern among authorities and organisations associated with motorcycle safety to formulate and introduce effective counter-measures.

This article updates and expands on earlier work by the authors which considered one aspect of the counter-measures problem, namely the rate at which design changes introduced for road safety and other reasons spread through the population of motorcycles registered for road use.

STATISTICAL CONTEXT

SCRAPPING, LIFE EXPECTANCY, AND PROPAGATION RATES

The key concept in this report is that of, a 'propagation rate', which represents the combined influences of vehicle 'scrapping' or 'life expectancy' rates, and rates of registration of new vehicles. The rate at which a vehicle population changes cannot be understood simply on the basis of the life expectancy of the vehicles concerned because this takes no account of the rate of new registrations, which also continually change the makeup of the population of vehicles on the road. This may be illustrated by *Table I*, where the scrapping rate is expressed in terms of numbers of vehicles, per cent of new registrations, and per cent of total vehicles registered in each year.

In terms of absolute numbers, *Table I* indicates more motorcycles were scrapped each year examined than any other single vehicle category except private motor cars. In terms of the percentage of new registrations coming in to maintain the vehicle population, the motorcycle population lost nearly the most, with 57 per cent of the new registrations being offset by scrapped vehicles: once again, station wagons and open commercials are closely similar. However, scrapped vehicles as a per cent of the total number registered showed motorcycles to be the most transitory group.

One element of the propagation rate, vehicle life expectancy, can be expressed in terms of vehicle survival functions which indicate the proportion of vehicles registered in a given year which can be expected to remain in the total vehicle population after a specified time period. In *Table II* a selection of survival rates for cars and station wagons, and motorcyles estimated from 1976 Motor Vehicle Census data (Australian Bureau of Statistics (ABS) 1978*a*) and New Vehicle Registration data (ABS 1978*b*) are compared with similar estimates derived from the 1971 Census of Motor Vehicles (Wigan and Thoresen 1977). Estimated survival functions for these two groups of vehicles are compared graphically in *Fig. 1.*

Irrespective of whether 1976- or 1971-based estimates are utilised the functions indicate a life expectancy for motorcycles of less than half of that of cars and station wagons. However, while the estimated life expectancy of cars and station wagons remained little changed, an apparent reduction in motorcycle life expectancy is indicated from six to five years. While part of this reduction reflects inadequacies in data which will

TABLE I

AUSTRALIA-WIDE CRUDE SCRAPPING RATES IN CONTEXT

(Source: Thoresen and Stella (1977))

Yearly Average Values Dec. 1971-June 1976	*Cars*	*Station Wagons*	*Light Commercials*		*Trucks*		*Buses*	*Motor-cycles*
			Open	*Closed*	*Rigid*	*Artic.*		
Number of Vehicles Scrapped (000's)	91.1	18.4	17.2	9.1	3.6	0.7	0.8	19.2
Vehicles Scrapped as % of New Registrations	46.6	57.9	59.1	57.6	24.2	39.0	53.5	57.2
Vehicles Scrapped as % of Total Vehicles on Register	2.4	2.4	3.9	5.2	0.9	1.9	2.9	8.1

TABLE II

Australian Vehicle Survival Rates
Motor Car and Station Wagons, and Motorcycles
Estimates Based on 1976 and 1971 Censuses of Motor Vehicles

Vehicles Surviving as a per cent of the Number Originally Registered	*(Average) Age of Vehicle in Years*			
	Cars and Station Wagons		*Motorcycles*	
	1971 Data	*1976 Data*	*1971 Data*	*1976 Data*
100	0.0	0.0	0.0	0.0
75	10.5	10.6	3.2	2.5
50	13.4	13.6	6.0	5.0
25	16.6	16.7	9.6	8.3

be described later, the underlying data still indicate a significant reduction in life expectancy.

A likely explanation for some reduction in motorcycle life expectancy lies in the buoyant economic conditions experienced by the motorcycle-owning population up to about 1975.

It should be noted that survival estimates have been deduced from numbers of *registered* vehicles, and there are numerous practical reasons to expect a substantial number of motorcycles to become or remain unregistered. The off-road agricultural utility motorcycle and the recreational off-road motorcycle markets both contribute to the unregistered motorcycle population.

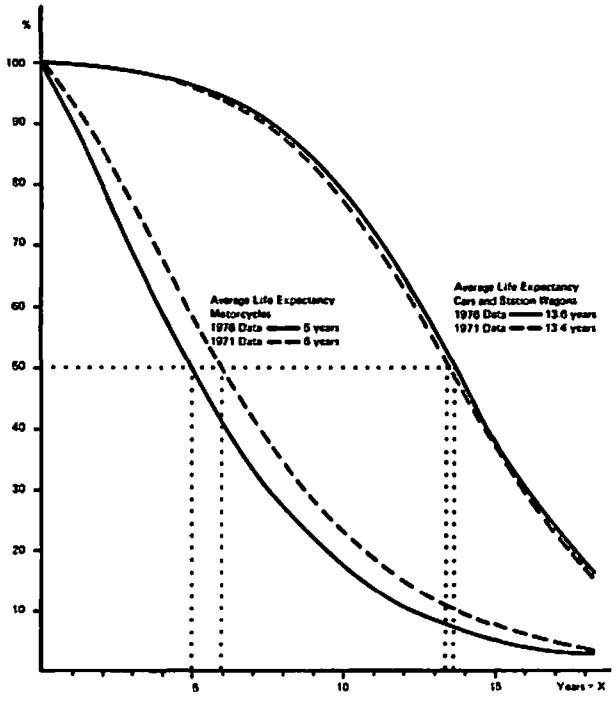

Fig. 1 — Estimated life expectancy — motorcycles and cars/stationwagons
Wagon values based on 1971 and 1976 Motor Vehicle Census data
(Source: Authors' calcualtions; Thoresen and Stella (1977))

It is clear that the remarkable difference in life expectancy between motorcycles and other vehicles will cause a fairly rapid rate of propagation of design changes. Consequently, even with a static or declining motorcycle population, design rules, draft regulations, and normal competitive marketing safety innovations applying to new vehicles can substantially affect the characteristics of the registered motorcycle populations in a relatively short period of time.

Some shortcomings inherent in using Motor Vehicle Census data for these purposes have already been mentioned. A substantial proportion of the registered motorcycle population at the time of each census was not classifiable by year of model due to limitations in registration records. While there was an overall improvement in data quality between 1971 and 1976 with this proportion dropping from 24 to 20 per cent, it is unfortunate to note that for the 1976 Census no year of model data were available for the Australian Capital Territory and the Northern Territory, coverage of South Australian data was poor, while deterioration in year of model coverage of West Australian and Tasmanian registration data also occurred. Coverage for the three eastern seaboard states improved, which is significant, as these states between them accounted for around three-quarters of the total motorcycle population.

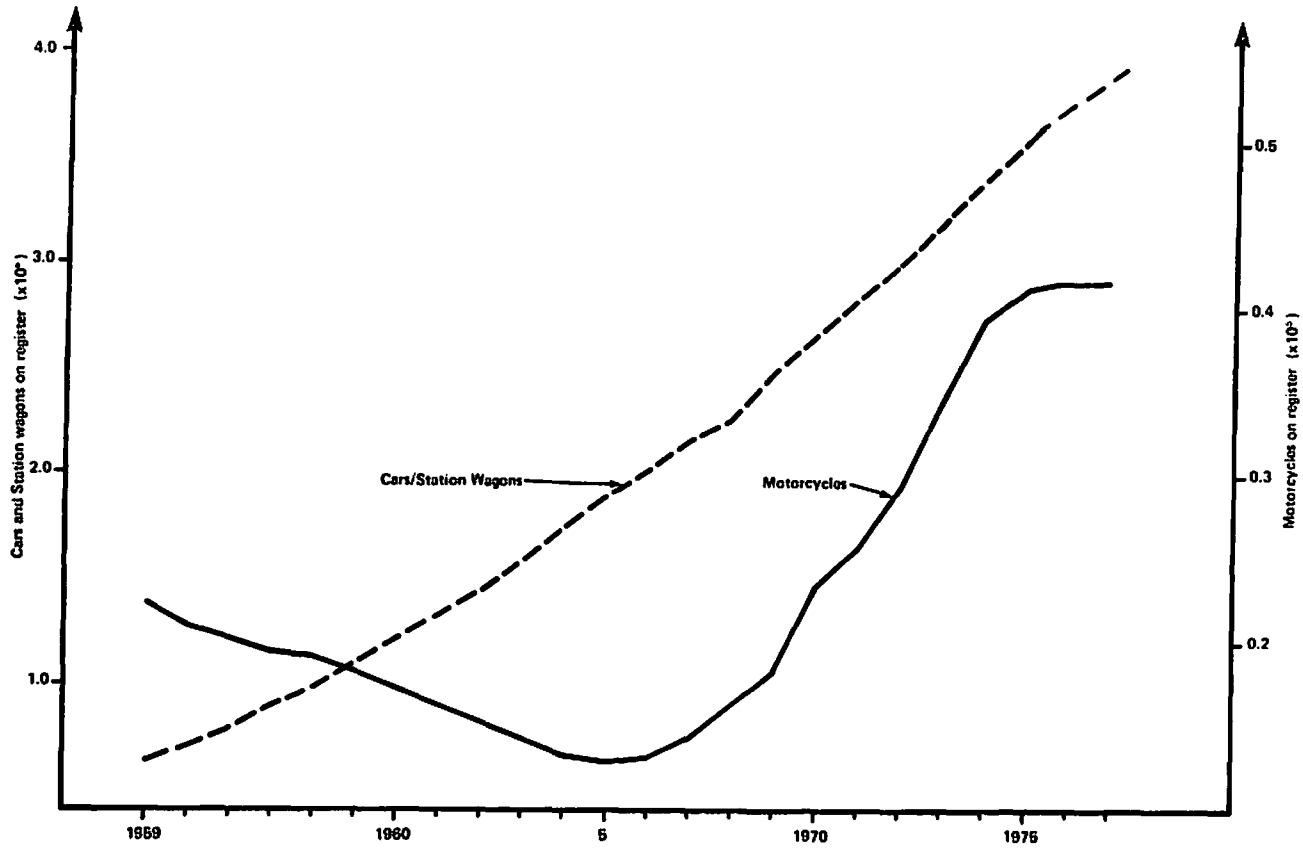

Fig. 2 — Trends in vehicle numbers — motorcycles and cars/stationwagons — total vehicles on register (Source: ABS (1978b))

In *Table III*, life expectancy estimates and new registration data have been utilised to estimate the historical rate of propagation of recently-manufactured vehicles through the car and motorcycle population for the years following the 1976 Motor Vehicle Census. Given that vehicle design rules have been introduced and made mandatory for registration of new vehicles after a given date, the figures give some indication of the penetration such measures would have had since the end of 1976. The Table shows that using 1976-based data the propagation rates for motorcycles over the two-year period examined were more than double that for cars and station wagons. A similar observation, applicable to the four-year period 1971-75, is yielded by 1971 data (Wigan and Thoresen 1977).

ANALYTIC FORMS FOR VEHICLE LIFE EXPECTANCY

This subject has been discussed in detail by Thoresen and Stella (1977). A detailed description of deficiencies experienced with data have already been rehearsed there. The main reasons for using Australia-wide data are interstate migration and inadequate detail in the categorisation of the vehicle types by year of model for specific states and territories. A number of different functional forms were used to fit the vehicle survival data available, and the logistic form

$$Y = 1/\{ \alpha + \beta \exp (\gamma (X - 0.25))\}$$

(where Y = the expected number of vehicles remaining on the register after X years as a fraction of the initial number) was found to give the best results for all categories of vehicle. In the 1976-based calculations functional form was made a little more elegant by removing the 0.25 term.

Table IV sets out the coefficients of the logistic survival functions fitted to 1976 Motor Vehicle Census data for cars and station wagons, and motorcycles, together with the respective coefficients of determination. Examination of the 1976 survival functions generates a number of interesting observations. For example, taking an equivalent number of cars and station wagons registered during a given year on one hand and motorcycles on the other, the functions indicate that the first 5 per cent of cars will disappear from the registered car population only after 5.7 years have elapsed; during which time some 60 per cent of motorcycles will have gone. Using 1971-based data the propagation rate was comparable for cars, but the figure for motorcycles was around 50 per cent. The attrition rate for motorcycles on register appears to be quite severe, the 1976-based data indicating that 8 per cent of newly-registered vehicles left the population in their first year compared with 5 per cent for the estimates based on 1971 data.

It is a moot point as to whether life expectancy for vehicles can be expected to remain stable over time. While estimated life expectancy between 1971 and 1976 appears to have remained stable for cars and station wagons, this was not so for motorcycles. Volatility in motorcycle life expectancy measured from registration data seems likely to be due to a variety of factors, including low cost and ease of storage of

TABLE III

COMPARATIVE PROPAGATION RATES OF VEHICLES REGISTERED IN AUSTRALIA AFTER 1.1.1976

Vehicle Group	*% of Vehicles First Registered after 1.1.1976*	
	On the Road at 31.12.76	*On the Road at 31.12.78**
Cars and Station Wagons	9.8	25.2
Motorcycles	22.4	65.0

* Estimated

TABLE IV

LOGISTIC VEHICLE SURVIVAL CURVES DERIVED FROM 1976 MOTOR VEHICLE CENSUS DATA

	Parameter Values			
	α	β	γ	R^2
Motorcycles	0.623	0.377	0.26	0.97
Cars and Station Wagons	0.992	0.008	0.36	0.98

unregistered vehicles, low capital cost and residual value, age specific ownership, growth of wrecking for parts, and ease of transition to and from off-road-unregistered usage.

TRENDS IN THE MOTORCYCLE POPULATION

The numbers of motor vehicles per head in Australia are high on a world scale (Organisation for Economic Co-operation and Development (OECD) 1977): this is true both for motorcycles and for cars; vehicles per head of population in both categories lie in the top three or four in the world. There are currently few 'mopeds' in Australia, unlike the rest of the OECD group of countries to which Australia belongs, and only an infant moped market at present. (Mopeds are five to ten times as important as motorcycles per head in most OECD countries.) Consequently motorcycles/head in other countries must be compared with Australia, and *not* powered two-wheelers. *Table V* summaries the overall values for Australia in recent years.

These ownership values *far* exceed such well known motorcycling countries as U.K. (12 and 248), France (7 and 280) and Japan (7 and 145) — for both motorcycles *and* cars (OECD 1977).

The smooth and regular increase in the number of cars and station wagons on register during the period 1959 to 1977 contrasts with variations in total motorcycles on register. In fact, recent registration data for December 1977 indicate the first small absolute decline in motorcycle numbers since 1964. The volatility of the motorcycle population illustrates the combined influence of a short life expectancy and significant variations in levels of new registrations, as shown in *Fig. 3.*

TABLE V

VEHICLE OWNERSHIP PER HEAD IN AUSTRALIA, 1975 TO 1977

(Source: ABS 1978b)

Date	*Total Australian Population (000's)*	*Number of Vehicles/1000 Population*	
		Motorcycles	*Cars and Station Wagons*
31.12.75	13 710	20.6	359.0
31.12.76	13 991	21.1	368.3
31.12.77	14 164	20.8	377.3

It is therefore quite likely that the present extremely high rate of propagation in the motorcycle market may decline slightly due to changing economic circumstances and tastes of the age group primarily concerned. The 'recreational vehicle' market filled by most motorcycles at present was recently found by one major distributor to be competing with funds for overseas travel and economic pressures and task factors are therefore probably of considerable importance. Investigations to assess these factors and put them on a firm statistical footing should be an early priority if serious attention is to be paid to the motorcycle component of the general young driver accident problem.

The agricultural, recreational off-road, minibike, and competition sections of the motorcycle market as previously noted are not generally subject to registration, but some idea of the relative importance of this part of the market may be gained from *Table VI* and *Fig. 4*, where Australian Customs Import Data (ABS 1977) and new registrations may be compared.

Table VI requires further comment. The rotary-engined motorcycles are drawn from the Suzuki RE5 (500 cc rotary) and the Hercules '3000' (350 cc rotary). The Suzuki accounts for almost all of these machines imported, and has now ceased production. In view of the heavy concentration of newly-announced and available motorcycles in the range 1000-1200 cc, it would be desirable to drop the 'rotary' classification for 'other' and make a specific group of 750-1000 cc machines, leaving the over-1000 cc machines to the 'other' category. The 'minibike' market is entirely below 250 cc, and almost every off-road recreational vehicle is below 500 cc capacity. Agricultural motorcycles are almost invariably 125 to 175 cc.

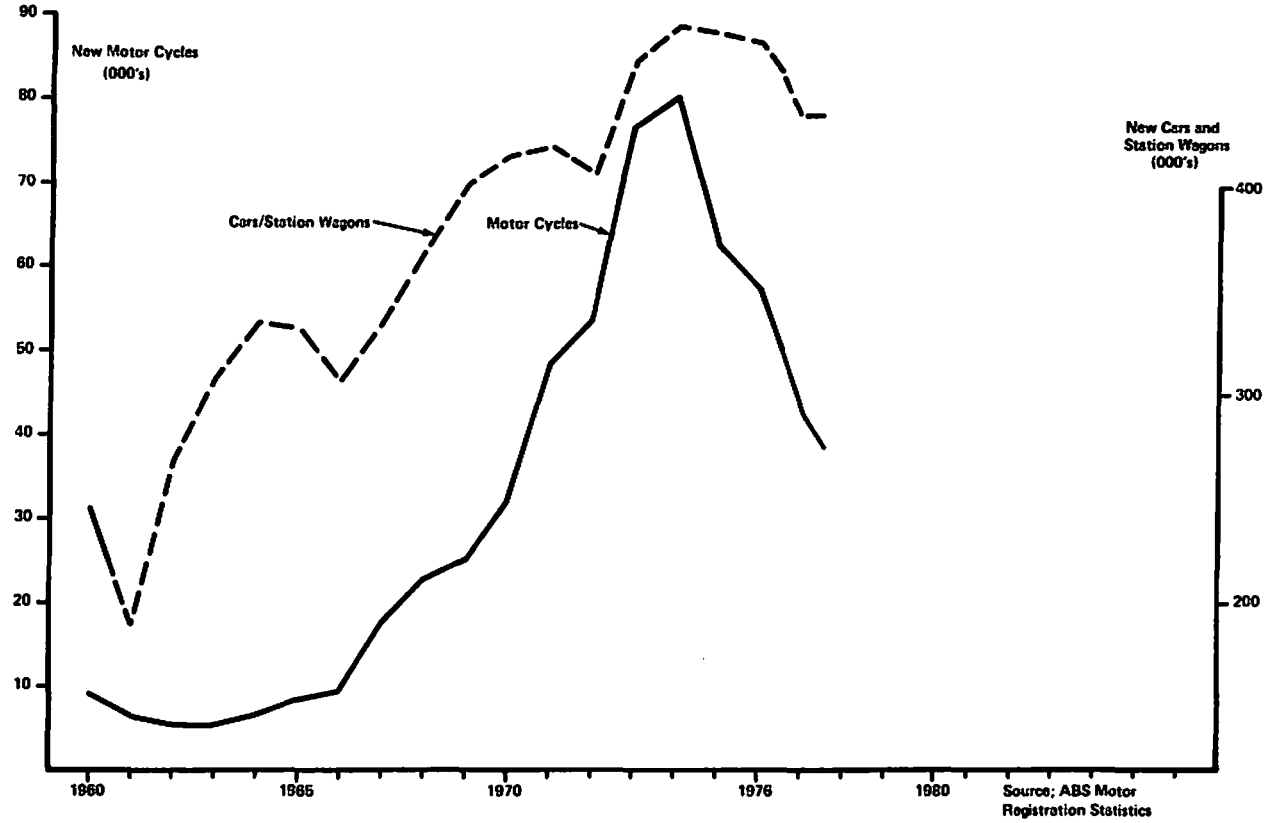

Fig. 3 — Numbers of new vehicles — registered motorcycles, cars/stationwagons

TABLE VI

AUSTRALIAN CUSTOMS RETURNS FOR THE IMPORT OF MOTORCYCLES TO AUSTRALIA

(Source: ABS Private Communication)

Categories Years (1.7-31.6)	*Rotary Piston Engines*	*Engines of less than 245 cc*	*Engines of 245-500 cc*	*Engines of 500-750 cc*	*Others*	*Total*
1976-77	1	48 591	19 599	9886	3514	81 591
1975-76	26	48 370	20 376	8272	4885	81 929
1974-75	264	57 622	25 664	7120	4384	95 054
1973-74	N/A	N/A	N/A	N/A	N/A	150 876
1972-73	N/A	N/A	N/A	N/A	N/A	139 505

N/A — Not available

The problem of accounting for stock levels weakens the relationship between imports and new registrations still further, but as Australia has as yet no noticeable domestic manufacturer or assembler of CKD* motorcycles or mopeds, further attention should be paid to import statistics due to their wider coverage.

The accident profile, not unnaturally, follows the overall total registrations (*Figs 2* and *5*), although the actual rate of accidents per machine has slightly improved over most of the period shown. It is the rapid growth in the numbers of machines which has brought the absolute numbers of motorcycle accidents to their present prominence. *Table VII* gives more detail on the declining numbers of new motorcycle registrations.

This Table shows how economic conditions are associated with quite different effects on the two markets, which must be regarded as distinct. Socio-economic data on ownership and use of motorcycles in Australia are quite alarmingly sparse, but what evidence is available confirms (James, Berenyi and Strang 1976) that motorcycles are owned and used predominantly by a

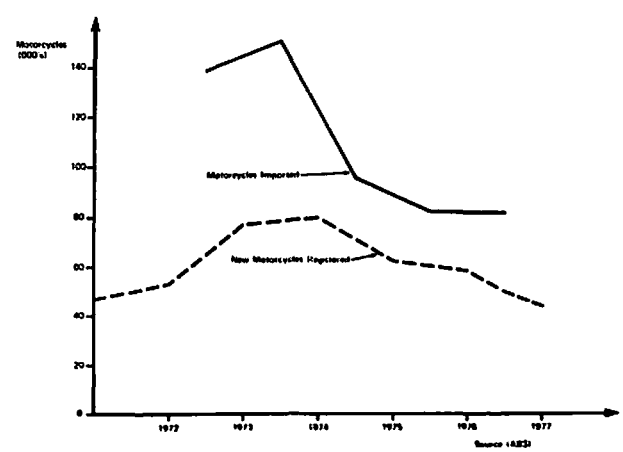

Fig. 4 — Total imports of motorcycles into Australia (Source: ABS Motor Registration Statistics and Customs Returns)

* Completely knocked down

TABLE VII

MONTHLY NEW REGISTRATIONS IN AUSTRALIA

(Source: ABS Motor Registration Statistics (ABS 1978a))

	*New Cars and Station Wagons Registered**			*New Motorcycles Registered**		
Month	*1976/77*	*1977/78*	*% Change*	*1976/77*	*1977/78*	*% Change*
July	38.2	38.1	− 0.3	4.3	3.2	−24.3
August	35.4	40.1	+12.7	4.3	3.5	−18.7
September	37.8	34.5	− 8.8	4.5	3.4	−25.5
October	37.0	34.0	− 8.2	4.8	3.8	−21.3
November	40.3	36.5	− 9.5	5.8	3.3	−43.1
December	46.2	35.2	−23.8	5.5	3.1	−43.5
January	31.6	30.1	− 4.8	4.3	2.8	−33.6
February	34.5	33.6	− 2.6	4.0	3.0	−24.8
March	38.5	34.9	− 9.3	3.5	3.0	−15.2
April	29.3	37.1	+26.6	3.0	3.1	+ 4.3
May	37.6	40.3	+ 7.0	3.3	3.2	− 0.7
June	40.5	38.1	− 5.9	3.1	2.6	−16.7
TOTAL	447.1	432.4	− 3.3	50.3	38.0	−24.4

* All numbers in (000's)

population in the very narrow age range of 17-25 years. This is the 'young driver' group which has such severe accident involvement in all types of vehicles and in hazardous pursuits, and which is known to function as a single group (OECD 1975) (irrespective of motorcycle or car usage), quite distinct in behaviour and social attributes from the non-driver population of the same age, or the remainder of the driving population. Adverse economic conditions clearly affect the 17-25 year age group in a manner different to the remainder of the population, and this makes forecasting hazardous without relevant economic forecasting inputs. An econometric model for motorcycle ownership and use should be developed to assess such factors. As previously mentioned, attention should be given to the future role of mopeds. For comparative purposes, it should be noted that in the U.S., like Australia a relatively new market for these vehicles, legislative provision has only recently been made for mopeds, and sales approaching 250 000 per annum were reached in only three years. Japanese and U.S. data on moped users strongly suggest that were Australia to make specific provision for mopeds a separate distinct user population from that currently utilising motorcycles could emerge. This population would include the under licence age, substantial numbers of married women and older age groups of both sexes, with an average age of 30 and over. The advent of such a market would require consideration from the point of view of road safety and design rule measures.

Preliminary results of the 1976 Survey of Motor Vehicle Usage (ABS 1978*d*) indicate that the average distance travelled per motorcycle per annum decreased from 6600 km in 1971 to 5600 km in 1976, a decrease of 15.2 per cent. Decreasing registrations of new motorcycles, and the slower rate of growth of the total registered motorcycle population have been accompanied by a decrease in the average rate of utilisation of motorcycles, and a decrease in the total number of motorcycle accidents involving injuries.

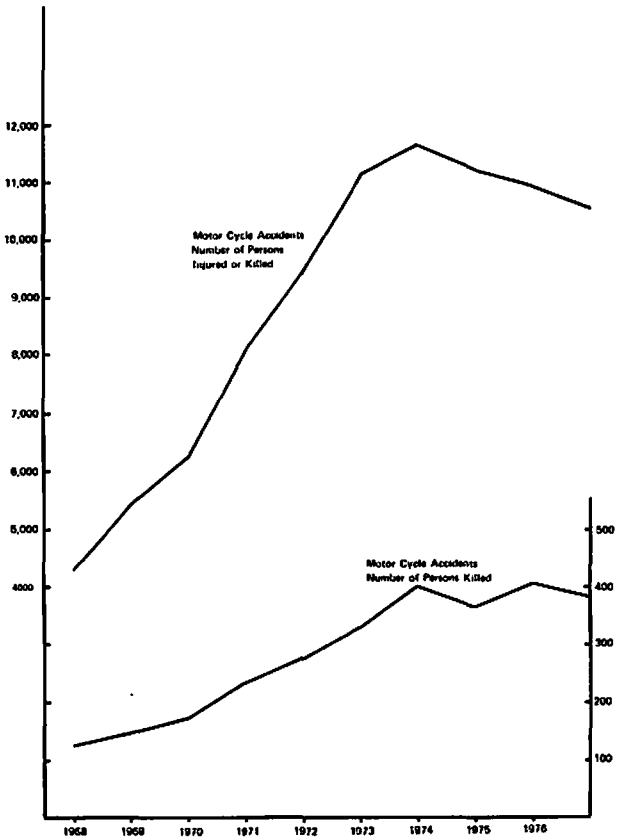

Fig. 5 — Motorcycle accidents 1969-1976
Number of riders and passengers killed or injured
(Source: ABS (1978c))

The decrease in numbers of new motorcycles since 1974 is a significant causal factor of this occurrence, given that an ageing motorcycle population is implied and unpublished data from the 1971 and 1976 Motor Vehicle Usage Surveys (ABS 1973*b*) indicate that as vehicle age increases average distance travelled by the surviving motorcycles decreases. A strong link with accident data exists, given that average distance travelled is a crude measure of exposure to accidents given a stable user population, i.e. mainly 17-25 year old males. As could be expected from decreasing registrations of new motorcycles and decreasing average utilisation, the number of

motorcycle accidents has decreased absolutely since 1974 as can be seen in *Fig. 5* and *Table VIII*. The total number of motorcycle accidents involving death or injury decreased from a peak of 11 687 in 1974 to 10 691 in 1976, a decrease of 8.5 per cent, the first sustained decrease in motorcycle accident numbers since 1968, although the accident rate per machine registered has been declining over a longer period. Accidents involving deaths, which accounted for 3.9 per cent of total motorcycle accidents in 1974, decreased in 1975, returned to 1974 levels in 1976, but fell again in 1977. However, stabilisation in the death rate is implied (Johnston 1977), indicating a change from the rapid increase in motorcycle deaths recorded since 1968.

Data on new registrations, utilisation, and accidents taken together imply that new registrations of motorcycles are a significant determinant of total motorcycle accidents involving casualties as long as the 'young male' driver market continues to be the only significant powered two-wheeler market in Australia. It follows that any recovery in numbers of new motorcycles registered is likely to be followed by a significant increase in average mileage travelled, and hence the number of accidents. Further unpublished data contained in the 1971 Motor Vehicle Usage Survey would appear to confirm this, as it was found that as motorcycle age increased, number of accidents per motorcycle declined. If any such increase was due to a different buying public (e.g. women and older people), or to smaller machines such as mopeds, the strength of such a relationship could be significantly weakened.

New motor vehicle purchases are a widely used economic barometer, as are hire purchase debts. Motorcycle purchases behave similarly, and are, in addition, also vulnerable to other factors such as taste and public pressure. The Industries Assistance Commission (IAC) passenger motor vehicles purchase model (IAC 1976) confirms these influences for Australian circumstances. Given that a significant part of the reduction in new motorcycle registrations can be attributed to short-term unfavourable economic conditions, particularly unemployment among the young, improving economic conditions are likely to generate a short-term increase in registrations of new motorcycles and a possible worsening in the motorcycle accident situation. The effect of adverse economic conditions identified previously by IAC is illustrated by the downturn in registrations of new cars and station wagons from 1974 shown in *Fig. 3*.

LONGER-TERM INFLUENCES ON THE MOTORCYCLE POPULATION

Population projections made by ABS (1976) indicate that the number of males in the only age groups presently using motorcycles will remain relatively static, increasing overall by only about 10 per cent in the 25-year period to 2001. Estimates are shown in *Table IX*.

The implication of *Table IX* is that population growth is unlikely to cause a significant increase in motorcycle population over the next 20 years. On the contrary, a relatively stable or decreasing motorcycle population is implied unless Australia follows world trends with a broader section of the population using motorcycles or mopeds, or economic circumstances alter the balance of choice towards motorcycles. A significant escalation in imported crude oil prices expected after 1985 with the depletion of Alaskan and North Sea oil may cause some increase in motorcycle numbers, given that motorcycles can be remarkably economical to operate. The moped domination of the Japanese market (Wigan 1977, 1978) by a new and more mature group of people than presently use motorcycles may not emerge unless an Australian legal definition of a moped as distinct from an undifferentiated 'motor vehicle' is enacted (for licencing, age or rider rules, design rules and draft regulations). Such a formal recognition of the moped category would bring

TABLE VIII

NUMBERS OF MOTORCYCLE RIDERS AND PASSENGERS KILLED OR INJURED 1969-1976

(Source: ABS 1978c)

Calendar Year	Motorcycle Accident*		
	No. Injured	No. Killed	Total
1968	4198	124	4322
1969	5289	148	5432
1970	6061	173	6234
1971	7825	235	8060
1972	9213	277	9490
1973	10 814	330	11 144
1974	11 287	400	11 687
1975	10 854	365	11 219
1976	10 566	408	10 974
1977	10 305	386	10 691

* Excludes pillion passengers

TABLE IX

ESTIMATED POPULATION NUMBERS (000's OF MALES) IN AGE GROUPS ASSOCIATED WITH MOTORCYCLE OWNERSHIP

(Source: ABS (1976))

Age Group (years)	June 1976	June 1978	June 1980	June 1985	June 2001
15-19	634.2	653.3	652.6	658.8	680.2
20-24	585.0	604.2	631.1	652.9	619.4
25-29	584.4	579.8	589.4	655.8	683.7
Total	1803.6	1837.3	1873.1	1967.5	1983.3

Australia back into agreement with the general provisions of almost all of the OECD nations. Decreasing registrations of new vehicles reduce the impact of design rules and other measures directed at new cycles, compared with the impact of such measures if introduced in a period of increasing motorcycle numbers.

THE FUTURE

FUTURE PROPAGATION RATES

The best present estimate of the future that can be used here is to assume no change in the segment of the Australian population using motorcycles, and no change in the types of powered two-wheeler purchased. If a legal distinction between mopeds and motorcycles were to be introduced both assumptions would be incorrect, and could require reassessment of the applicable propagation rates. Given the statistical context given earlier, the effectiveness of the introduction of a design rule, registration pre-requisite, or generally-offered modification to all motorcycles may be assessed. In the following it is assumed that the motorcycle life expectancy functions computed from the 1976 Motor Vehicle Census data will have some applicability up to 1983.

To illustrate the process, if such a general change were to have been applied with effect from 1 January 1979 to newly-registered motorcycles, how widespread would this change be in the population of vehicles on the register five years later, i.e. at 31 December 1984?

Two alternative futures have been assumed for the results in *Table X* although if new registrations of motorcycles continue to fall a total population below those assumed could well result.

(a) Case A:
the decrease in new registrations reverses and an average of 59-60 000 new machines are registered each calendar year until the end of 1984. This is equivalent to projecting the motorcycle population on the register as at 30 September 1976 by the rate of growth experienced in the period 1 January 1974 to 30 June 1976.

(b) Case B:
the decrease in new registrations of motorcycles continues and then stabilises to a level of about 35 000 per annum to the end of 1984.

TABLE X

Estimated Numbers of Motorcycles on Register as at 31.12.84: Total and Penetration of a Hypothetical Design Rule With Effect From 1.1.79

Estimated No. of Motorcycles 31.12.1984	*Proportion of Total Motorcycles on Register Manufactured to Comply with Hypothetical ADR taking effect from 1.1.79*
315 000 (Case A)	71.8
220 000 (Case B)	59.8

THE IMPLICATIONS FOR COUNTER-MEASURES

As any significant improvement in economic conditions would appear to imply an increase in motorcycle registrations, and hence accidents, there would appear to be a case to implement counter-measures involving the new motorcycle itself and/or the driver's equipment before this occurs.

In the longer term the severity of the motorcycle accident problem may reduce of itself to some degree without further action. However, absolute numbers of accidents will still be of a sufficient magnitude to invite counter-measures. This would occur with an ageing motorcycle population which is stable or declining: two reasonable alternative futures. Either situation would imply a lower propagation rate, suggesting that counter-measures effective after 1980 might well have only a limited effect on accident rates, compared with measures operative earlier. Second best measures — involving modification of existing motorcycles — would then become more attractive in terms of relative efficiency in effect. Both hypotheses are based on ownership remaining restricted to the present motorcycle-owning population. There would appear to be a substantial case, if design rules are to be considered, to implement such rules before any economic recovery causes a resurgence in motorcycle numbers.

DESIRABLE IMPROVEMENTS IN THE RELEVANT STATISTICS

As in the body of this report, attention is restricted to the motorcycles themselves, and excludes usage characteristics. The evaluation of the latter factors should prove feasible in the near future on the basis of the results of the 1976 Motor Vehicle Usage Survey and the Bureau of Transport Economics National Travel Survey, both of which are progressively becoming available.

Currently, Australia-wide data on the characteristics of the motorcycle population are generally restricted to the publicly available ABS data which is in turn derived from Motor Registry Records. The general areas of coverage are:

(a) number of machines on the register and new registrations;

(b) numbers disaggregated by make and State of registration, with differentiation between capital city and other areas;

(c) five-yearly vehicle census/usage surveys; and

(d) Australian customs data on categories of motorcycles imported.

Apart from improved coverage of year-of-model statistics by state registries desirable improvements in data are of two kinds.

(a) The disaggregation of the motorcycle market into *types of machines*, i.e. agricultural, trail, street, dual purpose street/trail, competition. Such a category cuts across all capacities and makes.

(b) Better data on the *machine itself* (power rating in kW, engine type (rotary 2 or 4 cycle), gross weight on the road (kg), and the passenger provision as supplied).

Provision of such data would require more detailed motor registration records to be maintained by the appropriate authorities, together with additional inputs by ABS during the aggregation and processing stages.

Non-registered motorcycles are not covered by any published statistics, and this area deserves closer attention:

(a) to quantify the legal evasion issues involved; and

(b) to assess the importance of dual purpose machines in regulatory and training contexts.

Possible techniques include sample surveys of past owners of previously-registered motorcycles, of retail outlets or trade organisations, and surveys of owners of machines which have never appeared on the register after sale or import; Census or Motor Vehicle Usage Surveys could well be adapted to provide much of these data on a regular basis. Customs returns would also provide better control totals if categories were to be altered appropriately.

CONCLUSIONS

Despite declining new registrations the short registered life of motorcycles suggests that safety measures directed towards the newly-registered motorcycle should still be accorded higher priority than in-use or retroactive regulation. The road safety implications of mopeds and their potential patterns of use will also require detailed consideration in the near future.

The official statistics concerned with motorcycles are not well organised for use on safety issues requiring details of different segments within this remarkably diverse market: the disaggregation presently available (by manufacturer) should be replaced by different a subclassification.

Socio-economic bases for forecasting are not considered here; nor are demographic issues. However, both should now be studied in detail as a basis for forecasting and assessment of the motorcycle's contribution to mobility and to road accidents.

REFERENCES

AUSTRALIA. INDUSTRIES ASSISTANCE COMMISSION (1976). The Australian market for passenger motor vehicles. IAC, Canberra.

AUSTRALIAN BUREAU OF STATISTICS (1976). Projections of the population of Australia 1977 to 2001: base year 1976 (Preliminary estimates).

—— (1978*a*). Motor vehicle census 30 September 1976. Bulletins 1 to 9. (ABS: Canberra.)

—— (1978*b*). Motor vehicle registrations 1977-78. (AGPS: Canberra.)

—— (1978*c*). Road traffic accidents involving caualties: December quarter 1977.

—— (1978*d*). Survey of motor vehicles usage twelve months ended 30 September 1976.

HOUSE OF REPRESENTATIVES STANDING COMMITTEE ON ROAD SAFETY (1978). Motorcycles and bicycle safety. (AGPS: Canberra.)

JAMES, R.S., BERENYI, J.S. and STRANG, P.McK. (1976). Approaches to training suggested by a questionnaire survey of motorcyclists in the Joint ARRB and DoT Motorcycles and Safety Symposium, June 1976. Australian Road Research Board.

JOHNSTON, I.R. (1977). The magnitude and nature of the motorcycle crash problem in Australia. 5th General Scientific Meeting: Royal Australian College of Surgeons, 16-20 May 1977, Melbourne.

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (1975). Young driver accidents. (OECD: Paris.)

—— (1977). Draft report of Working Group S13: prevention of accidents involving users of two-wheeled vehicles (unpublished).

THORESEN, T. and STELLA, P. (1977). Analysis of historical vehicle scrapping and survival patterns 1950-76. Proc. 3rd Aust. Transp. Res. Forum, 23-28 May 1977, Melbourne, Ministry of Transport, Victoria, Australia.

WIGAN, M.R. (1977). Motorcycle safety, transport and traffic control: overseas visit report, Japan (August 1977). Australian Road Research Board. Research Report, ARR No. 78.

—— (1978). Motorcycle safety: a review of data from overseas. Australian Road Research Board. Internal Report, AIR 812-3.

—— and THORESEN, T. (1977). 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.

M.R. WIGAN
D.Phil., M.I.E.(Aust.)

After obtaining a nuclear physics doctorate from Oxford, Marc Wigan has spent the last 12 years in transport. Six years were spent in research at TRRL, working on urban and inter-urban transport models, traffic restraint and pricing, and environmental evaluation. This was followed by a spell at Greater London Council as head of the Freight Section, set up to develop a comprehensive freight policy for the Greater London region. Dr Wigan came to ARRB to head the Traffic and Transport Division, and has published on freight, motorcycle safety, social and economic appraisal, transport analysis, and computer models. An active supporter of applied computing and information systems, he played a leading role in the recent acquisition of the mainframe computer at ARRC and the use of microfiche. Dr Wigan's professional activities include membership of the U.S. Transportation Research Board and U.K. PTRC Committees, and he has acted as an expert advisor on motorcycle and bicycle safety to the Federal House of Representatives.

T. THORESEN,
B.Ec.(Hons.)

Thorolf Thorensen graduated with a degree in Economics from Monash University in 1969. He subsequently joined the Federal Department of Transport and after working in a number of areas associated with the economics of surface transport joined ARRB in mid-1976. His current areas of interest include developing and improving the coverage of economic statistics associated with roads and road use and the measurement of vehicle operating costs.

ACKNOWLEDGEMENT This paper is presented with the permission of the Executive Director of ARRB, Dr M.G. Lay.