MOTORCYCLES AS TRANSPORT

MARCUS WIGAN[1]

Principal, Oxford Systematics Australia;
Professor of Transport Systems TRI Napier University, Edinburgh

ABSTRACT

Motorcycles, mopeds and scooters (powered two wheelers) are a vulnerable road user group that has to date received only limited professional attention. Continuing monitoring of crash involvements comprise the most reliable and almost the only data time series and the professional groups involved are almost entirely safety and public health professionals, and as a result their position in Australia has many similarities to that of bicycles 20 years ago. Consideration of the positive actions that traffic engineering and road construction and maintenance can make, the operation potential of road space management, and the balanced assessment of the basis and evaluation of the modal choices made by the users and the environmental consequences are only now beginning to attract serious effort.

[1] Email address: mwigan@vaxc.cc.monash.edu.au Website: http://www.geocities.com/mwigan/geoMRW.html

1 INTRODUCTION

Motorcycles, mopeds and scooters have formed an essential part of traffic flow in Melbourne for almost precisely 100 years. The motorcycle retail centre in Elizabeth St attracts a flow of tourists from around the world, celebrates its Centenary late next year, and is perhaps the oldest such centre in the world.

This long mobility history has not been matched by the same positive and informed professional and policy and support attention that other modes have received [1] [2]. For motorised and nonmotorised modes alike there is a widespread understanding of the positive and negative aspects of each mode, and investment to secure the best mobility and safety outcome while achieving the best levels of intrinsic advantage that each mode can offer to the very different needs of different sectors of the community. This was recently noted by the Government in Victoria, and a report on this subject was commissioned [3, 4] .

The present paper discusses some of the specifically-transport and traffic aspects of powered two wheelers required to reach the same level of even handed perspective for these modes as we do for all the others. As the necessary research and information is severely lacking in most areas, the results of a recent exploratory survey of Melbourne motorcyclists are covered, and some new results form the continuing benchmark VATS transport surveys undertaken by the Transport Research Centre at RMIT University.

It concludes with a number of areas where demonstration projects, monitored trials or research is appropriate to secure the full benefits of powered two wheelers at minimum cost to the community.

2 DISCUSSION

2.1 MOTORCYCLES AS TRANSPORT

The Victorian Motorcycle Advisory Council (VMAC has responsibility for advice on all aspects of motorcycle policy, not only safety. It was quickly realised that there was little information available on which to base this broader view, and that specific research was required to bring together the available information on demand, mode choice, emissions, ownership, economics. In early 2000 VicRoads commissioned Oxford Systematics to undertake a project to assess motorcycles as transport

This project brought together information on many different aspects of motorcycles and scooters, and fresh analyses were made of the continuing VATS (Victorian Transport and Activity Survey). In addition telephone, mail and direct response surveys were undertaken of approximately 1000 people, yielding 154 full responses (rising to 170 by so months after the end of the formal project. These responses shed new light on a number of previously unaddressed aspects of households with both cars and motorcycles, and on the determinants of choice of mode for a range of different purposes.

2.2 TRAVEL FLOWS AND PATTERNS OF DEMAND

The most fundamental characteristic of a mode of transport is that it provides a pattern of vehicle movements between different locations, leading to flows of such vehicles along different routes and road links.

This is almost completely unavailable for motorcycles. The most common situation where traffic or transport engineers encounter motorcycles is in terms of crashes and the levels of safety of their riders. It is not clear what is the best method of expressing such corrected safety levels. If the total number of crashes are considered irrespective of the number of risers active or the numbers of motorcycles on register, then this pays little heed to the levels of usage. If the rate of crashes /km is used then the number of trips (and thus activities served) is sold short. However any correction for the raw totals is better than none, and the levels of exposure in terms of time or distance are probably the most useful.

Even if these values are determined, thus does not give us any basis for forecasting the levels of demand for motorcycle use, or for estimating the levels of motorcycle flows along a given corridor or along a certain road. Such forecasts are an important part of traffic and transport planning, and are undertaken for all other modes.

There are a number of approaches to estimating traffic flows. A series of traffic counts can be combined to estimate a matrix of movements between different points. This method of estimating demand has proved to be increasingly useful for freight movements, where other techniques have not yet proved entirely satisfactory due to the comparatively low volumes of freight vehicle movements and the problem of estimating movements from limited interview data.

Motorcycles have exactly the same problems. The trip generation rates are not easily determined, and the low overall volumes of motorcycle trips make most efforts to build a pattern of origin-destination movements unrewarding. Unlike freight vehicles, cordon traffic counts rarely if ever pick out motorcycle movements even in classified counts. This makes matrix estimation methods unworkable using current data, although a real prospect for the future.

Motorcycle flows can be found in a large number of classified counts carried out by VicRoads. These counts are usually made to obtain data for a specific intersection, or for some design or operational problem rather than as part of a program to obtain a statistically reliable pattern of vehicle movements across the network. 757 previously unexamined counts were extracted from VicRoads records as part of the research [3], and are summarised as Table 1.

Table 1 Motorcycles as % of traffic in VicRoads manual traffic counts (1997-2000)

	Average % of Motorcycles			Number counted		
Year	4hr	12hr	24hr	4hr	12hr	24hr
1995	0.30%			18		
1997	0.30%	0.40%	0.40%	40	4	36
1998	0.40%	0.90%	0.50%	181	30	90
1999	0.40%	0.60%	0.60%	166	72	48
2000	0.50%		0.50%	72		174
Over All periods		0.50%		All	757	

The extent of bias in these values is unknown, but the Victorian Motorcycle Crash Case Control Study provides a different framework to assess this. This study examined the characteristics of motorcycle crashes across Victoria, with follow up data collection at the crash sited. Once again, the distribution of crash sites is not necessarily a true reflection of the patterns and level of motorcycle flows, but are clearly related to them

Table 2 Motorcycles as % of total traffic in Case Control Study

% Motorcycle	Local Roads	Collector	Secondary Collector	Primar Arterial
Road Type	0.75%	0.43%	0.53%	0.47%
	Weekend		Weekday	
Day	0.50%		0.36%	
Night	0.59%		0.40%	
	Case Control	**Victoria (ABS)**	**Australia (ABS)**	
Overall	**0.49%**	0.80%	0.90%	

[5]

The difference between motorcycle flows on primary arterials and collector roads is significant, but there are no other significant pairwise comparisons. There is a consistent trend for motorcycles to comprise a larger fraction of the traffic away from major highways. Nevertheless, the overall fraction of vehicle flow of 0.50% and 0.49% between the VicRoads and Case Control findings suggests that 0.5% of traffic flow levels would be a good initial guide to motorcycle flows in most situations.

A further traffic flow contribution can be drawn from the Case Control Study.

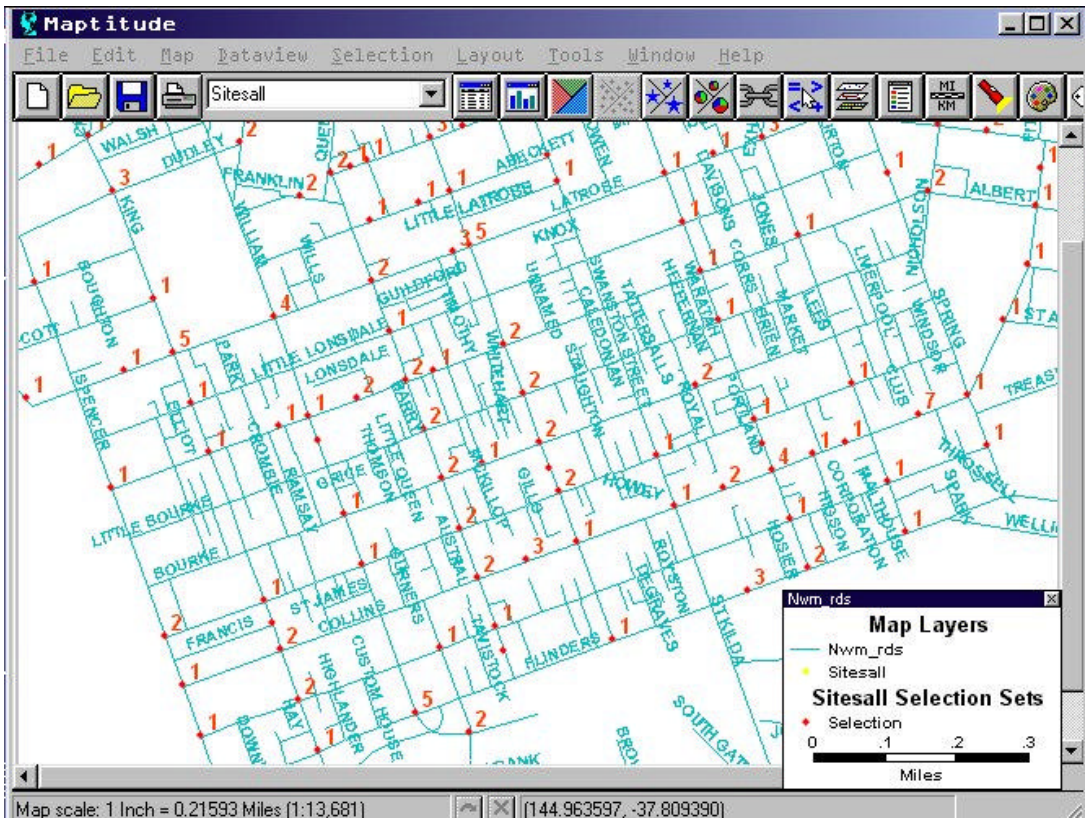


Fig. 1 Motorcycle crashes from CrashStats 1991-1995 in Melbourne CBD

Analysis of possible relationships between motorcycle flows and safety characteristics of the roads and sites roads where crashes had occurred showed that the only single factor with a significant relationship to motorcycle clashes was motorcycle flows – and that this one factor explained 79% of the variance.

CrashStats is an extensive database in geographic format of all crashes reported to the Victorian Police. The relationship found between crashes and flows can be inverted to estimate motorcycle flows on roads, once a GIS was available with the motorcycle crashes installed.

Number of Crashes during the study = 6.5 x mean number of motorcycles observed per hour

By expressing this as: motorcycle/hr= 0.154 * Crashes on each section of road

The full Victorian crash database was loaded into a GIS, and. Fig. 1 shows the levels of detail available on crashes in the CBD is adequate to use this relationship as first estimate of the patterns of motorcycle flows. The patterns of movement in the CBD are more complex than in rural areas and the density of crashes higher. However this approach offers a first approximation to motorcycle flows in a manner complementary to the crude 0.5% guide derived from classified counts data.

2.3 CAPACITY EFFECTS

2.3.1 Measurements in countries with low densities of motorcycle usage

Once demand and flow have been estimated, the next question is the capacity impact. Here there are sparse but useful items of information accessible from a range of different sources. The key areas where small numbers of vehicles may have a disproportionate impact are saturated and signalised intersections. The ability of motorcycles to make highly effective use of limited traffic capacity is seen every day as police and other vehicles slip though heavy traffic. The impact of such movements on capacity are not well measured in the literature, but the assumption that a motorcycle is equivalent to a car (1 PCU or passenger car unit) is highly unlikely to be the case when traffic filtering is involved as the movement appears possible even when traffic has come to a stop in heavy congestion conditions.

This suggest that the PCU equivalent of a motorcycle, a scoter, a moped or a bicycle can be very small indeed in such situations, leading to additional capacity over the assumed saturation conditions. However there are as yet few studies to assess this capacity contribution effect for bicycles, mopeds, scooters or motorcycles in oversaturated city conditions, but there has been one on the capacity impacts of free running motorcycles in freeway conditions. This work measured headways, and deduced a PCU equivalent for motorcycles in free-running freeway conditions of 0.5 +or- *0.1*

Table 3. Headways in free running freeway conditions in the UK

Slow lane Sample		Mean	Standard	Fast Lane Sample	Mean	Standard
Vehicle	Number	Headway	Error	Number	Headway	Error
Car	807	1.70	.041	1851	1.433	0.02
Van	47	2.05	0.23	52	1.707	0.11
Bus/coach	10	2.22	0.20	12	2.737	0.65
NonArtic Truck	119	3.34	0.27	19	3.005	0.48
Artic Truck	42	4.89	0.57	2	3.415	1.29
Motorcycle	7	1.57	0.51	8	0.797	0.09

[6]

> "*Motorcycles (have) lateral freedom of movement which enabled them to pass the reference line alongside a vehicle in the same lane. Under such circumstances the effect of their presence on other vehicle types, and vice versa, is difficult to assess* [6] (p7)

Similarly, for turning movements at signalised intersections one would expect slow moving vehicles to offer a higher PCU capacity than faster ones. [7] found PCU values for motorcycles of effectively zero:[0.0 + or – *0.01*] at saturated intersections in Barnet in North London The enforced traffic streaming by motorcycles (presumably taking gaps between the lines of vehicles or moderation of erratic car movements) may be the factor that led to an enhancement of intersection capacity and more than compensated for the road space used. (The equivalent PCU value for bicycles was 0.6).

Table 4. Saturated intersection PCU Equivalences for Motorcycles in the UK

	Asynchronous measurements				**Synchronous measurements**		
Straight on	**PCU**	**SE**	**No. of vehicles**	**PCU**	**SE**	**No. of vehicles**	**of**
Car	-vb1		688		1		1460
Van	1.14	0.09	51		1.28	0.14	30
Bus	1.79	0.15	22	1.61	0.21	10	
Truck	1.74	0.16	17		1.59	0.29	14
Motorcycle	0.04	0.15	23		-0.08	0.17	14
Left turning values (in UK and Australia this does **not** require a turn across facing traffic)							
Car	0.89	0.08	65		0.89	0.10	46

[7]

These results suggest that switches from car to motorcycle – and indeed from bicycle to motorcycle – could well have beneficial capacity effects at the most critical – and expensive – areas in congested networks.

2.4 CAPACITY MANAGEMENT FROM COUNTRIES WITH VERY HIGH MOTORCYCLE USAGE LEVELS

Measurements of such effects are best done in countries such as Malaysia and Indonesia where there are very high levels of motorcycle use, as the effects can be measured more effectively. Two specific examples are considered here.

• Intersection capacity gains from motorcycle filtering and

• The effectiveness of motorcycle exclusive lanes.

The potential 'free' capacity available from the ability of motorcycles to filter though traffic at stoplights has recently been found to be a key benefit in Indonesia. Analysis of the effects on intersection capacity at saturated signal controlled intersections was carried out to assess the impacts of 'Q—fliers' [8] (motorcycles which filter to the front of the stationary traffic and leave the front stopline within the first six seconds after the change in signal to green).

The data was collected using video methods, as automatic data collection proved to be inadequate, and analyses were carried out of the shock wave effects and the capacity impacts of these early departures from the stop line. The overall result was that up to 40 motorcycles could be found to leave in this critical first 6 seconds, and that the analysis showed a zero capacity impact of this substantial vehicle capacity addition to the intersection cycle.

In combination with Branston's turn-capacity measurements (zero for motorcycles, 0.6 for bicycles), this suggests that **both** types of roads based vulnerable road user (bicycles and motorcycles) should be considered for advanced stopline access and preferential treatment at intersections. The capacity impact of motorcycle access is clearly likely to be minimal, in addition to the potential for safety gains.

The allocation of road space to favour safety disadvantaged vehicles is well established for bicycles, but no such equivalent road space allocation steps have yet been taken in Australia for the other – often more worryingly vulnerable mode, motorcycles. It is increasingly necessary to allocate this scarce and expensive resource with a more consistent basis for each mode [9].

Recent research results from Malaysia on allocating road space to motorcycles, the exact analogy with bicycle lanes, suggests that this could be a very positive measure. A 39% reduction in crash levels was found in a recent study [10] of the first exclusive motorcycle lane known to have been installed in the world, consistent with the formal policy that the Malaysian Government now has in place [11] for installing exclusive motorcycle lanes (see Appendix A for the details). The Malaysian evaluation found a modified exponential relationship between accidents and traffic volumes, and a significant shift in the exponent in the motorcycle component after the introduction of the lane in 1994. the effects in a country such as Australia with lower motorcycle volumes would probably be far smaller, but the positive direction of the effect is unambiguous.

While there is no suggestion that such large effects would be found in Australia, with what is typically a tenfold lower percentage of motorcycles and powered two wheelers in the traffic stream, the signs are unambiguously in favour of serious consideration of positive road space management for powered two wheelers.

Positive traffic management measures in terms of road space allocation and access are evidently worth pursuing, and only the lack of systematic positive consideration of **all** modes of transport in traffic management provision has allowed this opportunity to missed until so recently.

2.5 COMMUNICATING TRAFFIC MANAGEMENT AND DESIGN INFORMATION

The lack of transport and traffic training, briefing and design materials for powered two wheelers in both literature and in tertiary courses has limited the ability of many engineers and planners to address relevant issues in an informed manner. VicRoads has for some time produced a series of Cycle Notes, to communicate such information to the engineering, consulting and design communities and these have proved to be very useful. These draw to some extent on the appropriate part of the general AustRoads Guide to Traffic Engineering for Bicycles [12], and a recent guide aimed at the safety aspects of motorcycles has now also been produced [13].

VicRoads provides the secretariat for the Victorian Motorcycle Advisory Council, and has recently begun to issue a series of VicRoads Motorcycle Notes to communicate the available advice in the AustRoads Guide and to extend the communication of motorcycle-relevant factors to the professional community. The notes issued to date [9, 14-19] have been drafted by the present author in consultation with VicRoads, researchers and other parties.

These notes have also proved to be popular with end users, and a general finding from the recent VMAC report on motorcycles as transport highlighted the enthusiasm of Local Government to make effective use of such information and advice once they could obtain it [4].

The response has highlighted the need for more specific materials covering transport planning, traffic engineering and evaluation of motorcycles and powered two wheelers. This need is apparent both for training and for operational use. Similar needs have been recognised for the other vulnerable road users, bicycles and pedestrians, and a relevant resources CDRom [20] has been issued by the US Government. An extension of this CD to include resources for all forms of powered two wheelers would be very useful, although it is very likely that each major country will have to produce a tailored version of such a vulnerable traveller CdRom.

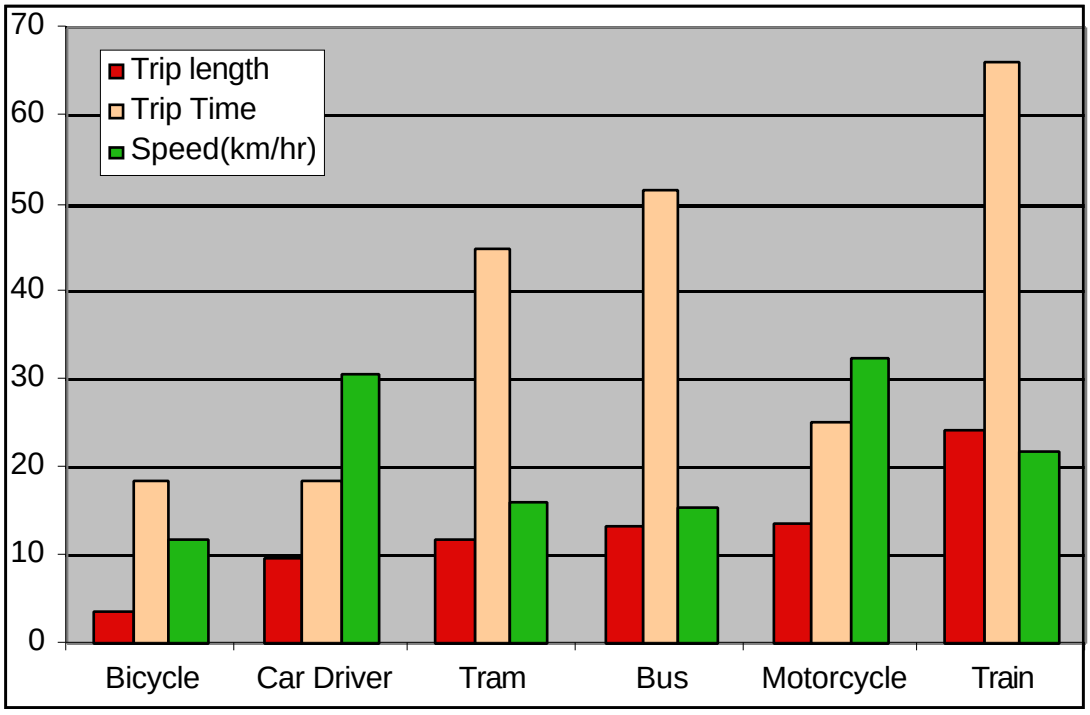
2.6 WHAT KIND OF TRAVEL PERFORMANCE ENVELOPE DO MOTORCYCLES PROVIDE?

The general professional perception of motorcycles is that they are mainly of interest for safety reasons. There is after all too little information about motorcycles or motorcyclists from any other standpoint. This has led to a lack of appreciation of the functional task that they provide. What kind of performance envelope do cars, bicycles, motorcycles etc provide? This question allows the different strengths

and weaknesses (depending on perspective) of each mode to be considered in a consistent manner.

One of the best continuing transport surveys in the world (VATS [21]) has been operated in Melbourne for over six years, and is operated on a continuing basis.

Fig. 2 Travel times and speeds by mode in order of trip length: VATS 1995-8



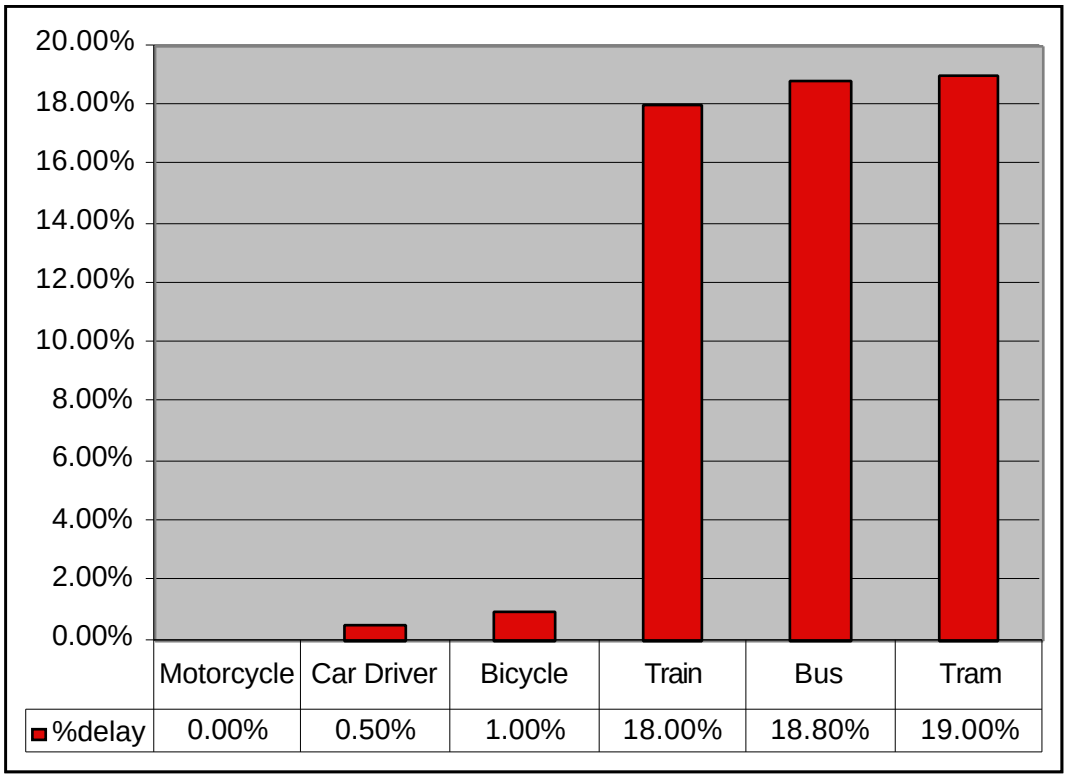
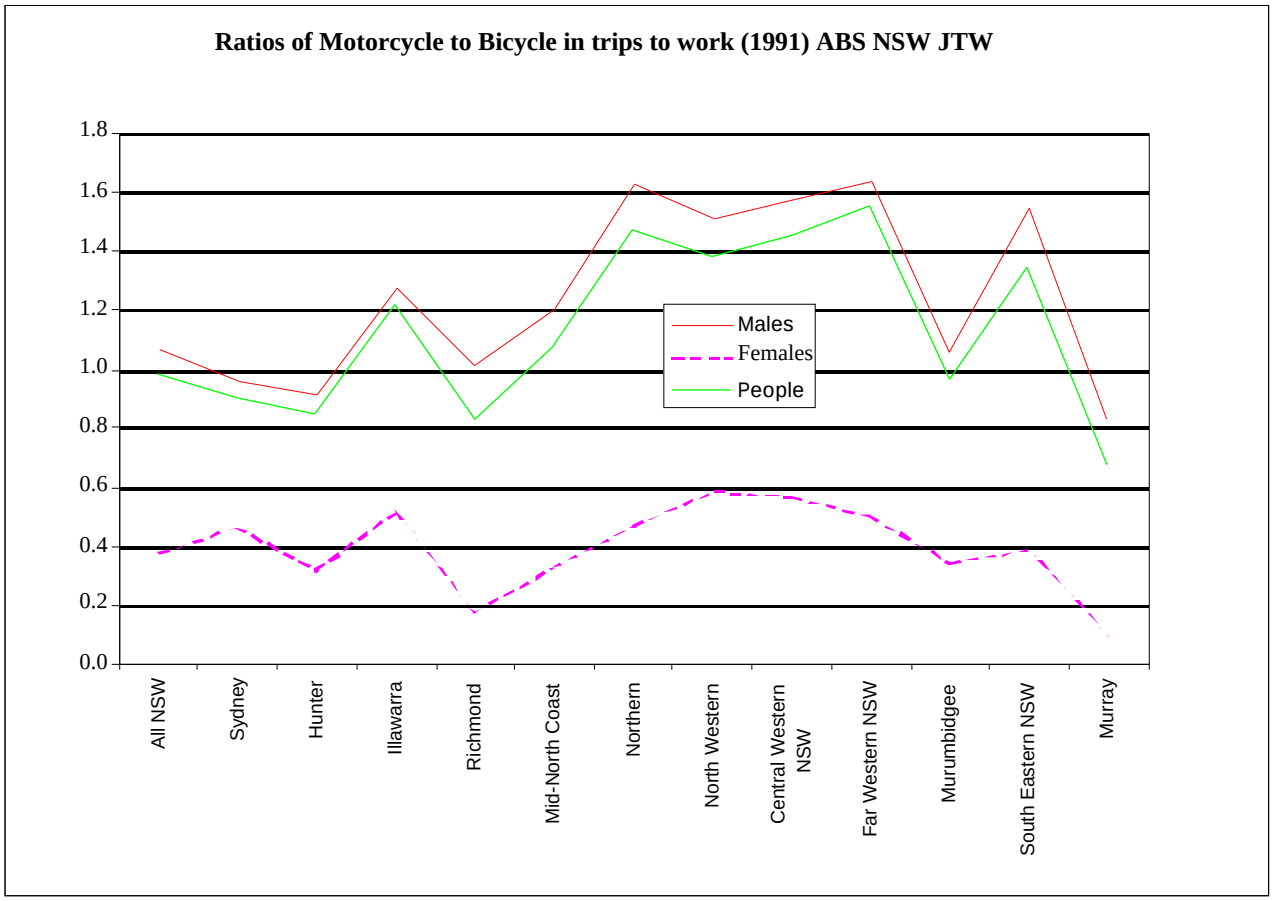


Fig. 3 Modes in order of % of delay as percentage of trip time: VATS 1995-98

Figures 2,3 provide a basis for considering these performance envelopes. Fig. 2 shows that motorcycle journeys are on average longer than any other mode – including car - than train; are carried out at the highest average speed, and in the

third shortest trip time. This is a very high performance long range performance envelope, and clearly meets a very large fraction of the transport envelope required for many journeys. Luggage and carriage of more than one additional person being the obvious areas where limitations will be felt, but as average vehicle occupancy is so low, this has only a limited effect on performance envelope. This performance envelope is measured here over all trips taken under all times of year and in all weathers.

Fig 4. Journey to work by motorcycle and bicycle in NSW in 1991



Bicycles offer the shortest distance, the lowest mean speed and the same (equal shortest) average trip time as cars. Their suitability for short range travel is clearly evident, as this graph shows what people actually do, not what they say that they do. The second graph shows how much of the time each mode is stationary or delayed in transit, and the passenger takeup/setdown of public transport is clear, However the ability of both bicycles and motorcycles to reduce stopped time in transit is clear. This also suggests that the driving cycles for evaluating motorcycle movement emissions should be corrected (downward) for the levels of emissions produced due to the lower stopped time in comparable traffic situations.

Just as the work on travel time on road assisted bicycles to be take seriously as a full mode of transport when analysed by the Victorian State Bicycle committee in the early 1980's [22, 23], so too should the VATS results assist planners and engineers to appreciate that so too are powered two wheelers full participants in the transport system.

In absolute terms, motorcycles and bicycles are approximately similar in their level of use in the journey to work (see Fig. 4). Motorcycles are used significantly more by males. This is true for both bicycles and motorcycles.

2.7 ATTITUDES OF MOTORCYCLE USERS TOWARDS THEIR CHOICE OF MODE

Most motorcyclists also have access to car, this means that the choice of mode in such households is a key question The assumption that if a motorcycle is owned that it will always be used is untrue. A survey done as part of the Motorcycles as Transport project gives some insight into the differences between car owning (ie only car owning) and car plus motorcycle owning households, as well as gender effects and attitudes towards the choice of mode. These results are strongly indicative, but are really a starting point for closer examination and investigation of the factors that influence mode choice where motorcycles are an option. Data on personal characteristics as well as the journey purpose are important.

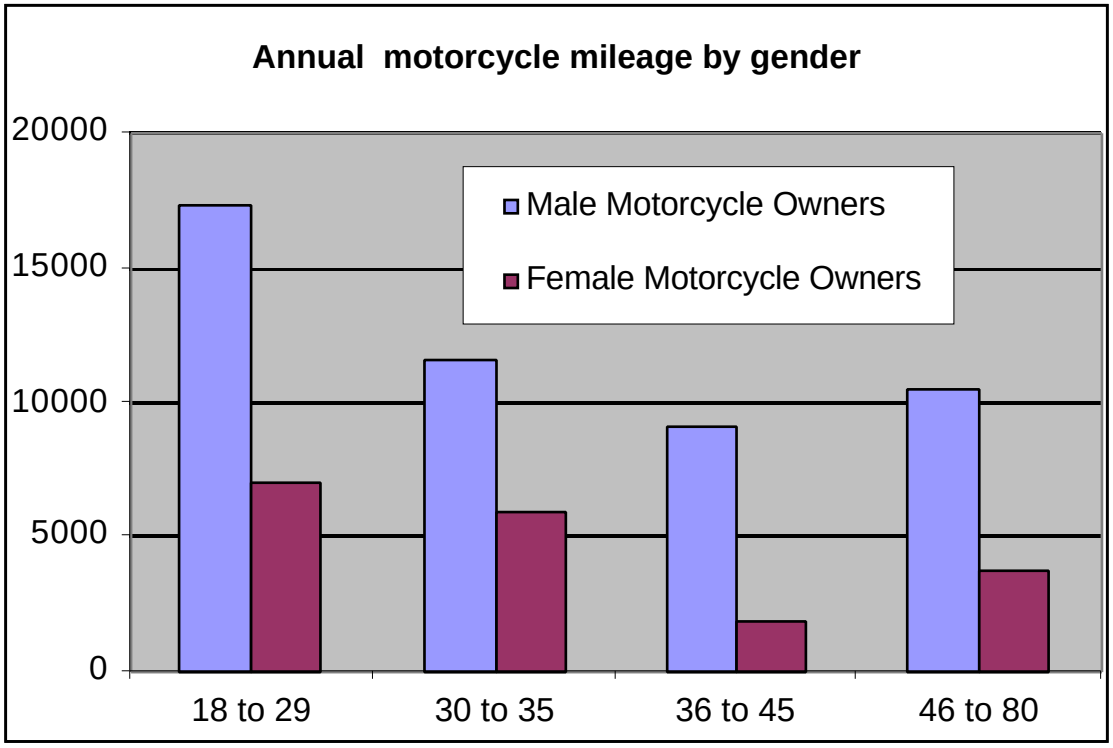


Fig. 5. Mean annual mileages by motorcycle by gender of respondent [4]

The annual mileages show evidence of a new development in motorcycling: riders returning to motorcycling when they get older. This affects both men and women. The survey contains a number of biases that do not allow these values to be trusted as general measures, although in good agreement with previous Victorian surveys of motorcycle mileage. The relative values of male to female mileages are more reliable, as these ratios are subject to less estimation bias.

The question of modal choice was addressed in the survey, and only one aspect will be presented here: the role of intrinsic enjoyment as a factor in motorcyclist mode choice decisions.

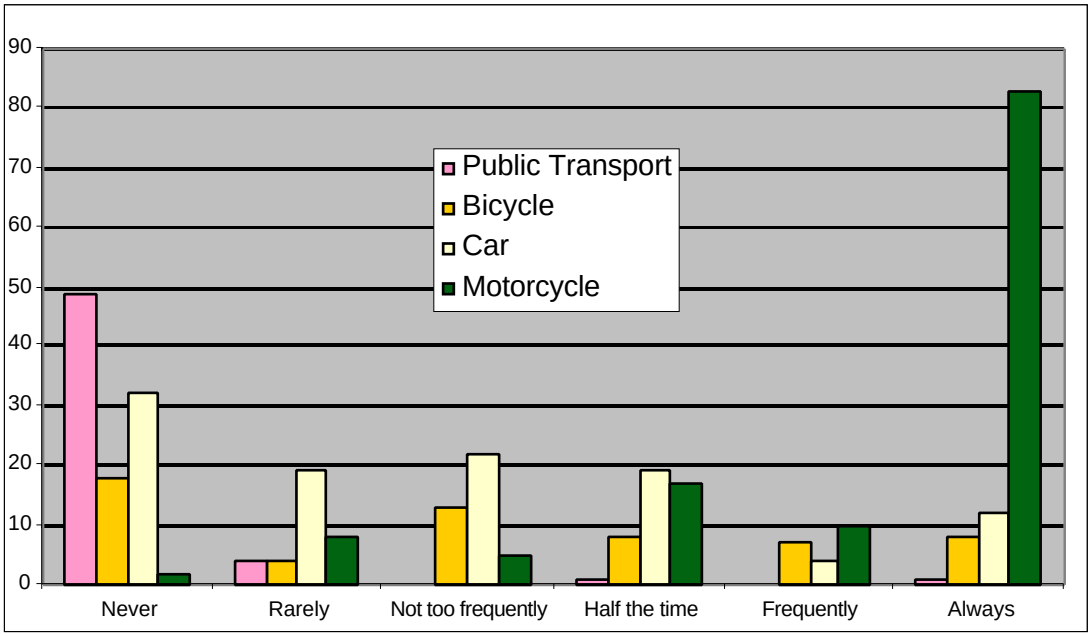


Fig. 5 Use of different modes for enjoyment: motorcycle owners

Motorcyclists, who almost all also have cars, clearly enjoy the process of riding, and any models of mode choice behaviour will need to take account of this factor..

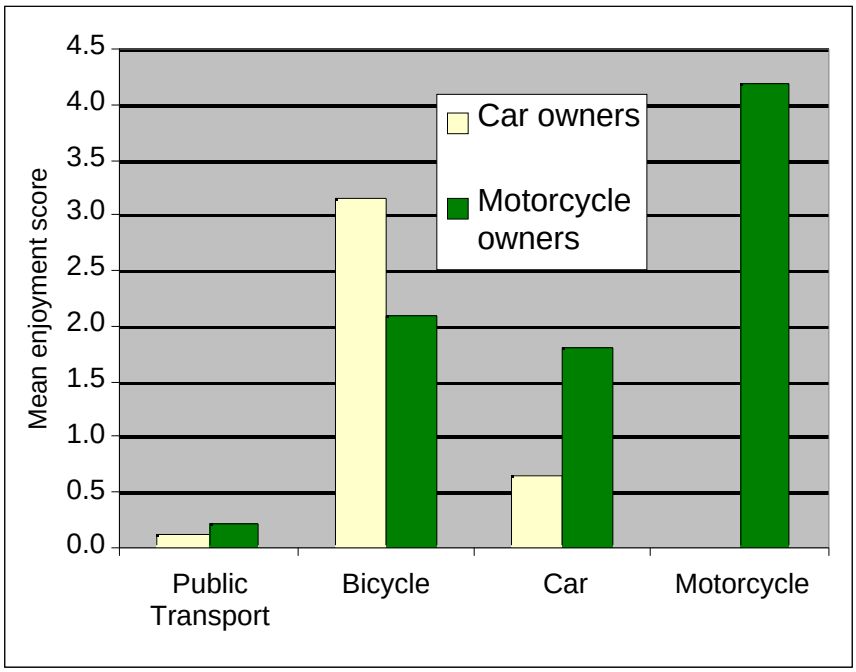


Fig. 6 Enjoyment as a factor: car owners (only): motorcycle owners

When the two populations, of car-only households and motorcycling households, are combined the intrinsic affinity of motorcyclists for driving/riding becomes even more marked. The motorcyclists like driving cars more than car drivers do who have chosen not to have a motorcycle; motorcyclists enjoy riding bicycles almost as much as car drivers do and there is even a slight suggestion that public transport is enjoyed slightly more than car driver do.

These results suggest that building mode choice models specifically to include motorcycles would be useful for both transport planning and forecasting, as well as for safety analyses.

3 CONCLUSIONS

A selection of aspects of motorcycles in traffic and transport contexts have been described. in each case there is a clear issues that need to be understood and acted upon in transport and traffic planning and management. The issues covered are only a selection of those that need to be considered. However there are a number of areas where investigations, trials or demonstration projects would be worthwhile - but.only a few examples will be listed here, as the objective of this paper is to demonstrate that treating motorcycles as full traffic and transport odes requires some fresh work and attention and that the professional foundation is currently inadequate to service this mode of transport in a balanced and informed manner in planning, design and operations. Work is needed on

• Capacity management: advanced stoplines, intersection treatment and lane access

• Demand estimation predicting ownership and usage levels

• Modal choice; factors that determine the selection of motorcycles for travel

• Emission factors: adjustment of driving cycles due to different traffic flow speeds

Motorcycles provide an effective means of transport with many valuable characteristics, and a high level of vulnerability. Unlike other vulnerable modes, positive traffic and transport planning and physical provision to address risk reduction and gain the best from the mode has to yet be started in Australia, and the necessary understanding of travel and choice characteristics is still wanting.

4 ACKNOWLEDGEMENTS

Some of the work reported here was carried out as part of a project for the Victorian Motorcycle Advisory Council and VicRoads, and we are pleased to acknowledge the positive approach of VicRoads and VMAC to presenting this work. However, the opinions and conclusions drawn here do not necessarily reflect their views, and are solely those of the author.

5 REFERENCES

1. Wigan, M.R., *User issues in motorcycle safety*, in *ARRB-DOT Symposium on Motorcycles and Safety*. 1976, Australian Road Research Board: Vermont, Victoria. p. 95-118.
2. Wigan, M.R., *User issues in motorcycle safety: Japanese text*. 1977, Honda Motor Company, Tokyo, Japan.
3. Wigan, M.R., *Motorcycles as transport: Volume 2 - Appendices to Powered two wheelers in Victoria*. 2000, Vicroads on behalf of the Motorcycle Advisory Council by Oxford Systematics: Melbourne Australia. p. 63.

4. Wigan, M.R., *Motorcycles as transport: Volume 1 - Powered two wheelers in Victoria*. 2000, Vicroads on behalf of the Motorcycle Advisory Council by Oxford Systematcics: Melbourne Australia. p. 63.
5. Haworth, N., et al., *Case-control study of motorcycle crashes*. 1997, Monash Accident Research Centre for the Federal Office of Road Safety: Canberra. p. 261.
6. Branston, D., *Some Factors Affecting the Capacity of a Motorway*. Traffic Eng Control, 1977. **18**(6): p. p304-7.
7. Branston, D. and H. Van Zuylen, *The Estimation of Saturation Flow, Effective Green Time and Passenger Car Equivalents At Traffic Signals By Multiple Linear Regression*. Transp Res, 1978. **12**(1): p. p47-53.
8. Powell, M., *Modelling the Behaviour of Motorcycles At Traffic Signals*. Traffic Engineering And Control, 1997. **38**(10): p. p521-8.
9. Wigan, M.R., *Managing road space*. Traffic Engineering and Control, 2000. **41**(10): p. 1.
10. Umar, R., G.M. Mackay, and B.L. Hills, *Multivariate analysis of motorcycle accidents and the effects of exclusive motorcycle lanes in Malaysia*. Journal of Crash Analysis and Injury Control, 2000. **2**(1).
11. Road Safety Highway Planning Unit, *Quality of roads in Malaysia: report to the Economic Planning Unit Prime Ministers Department regarding Malaysian quality of life composite index*. 1998, Ministry of Works Kuala Lumpur Malaysia.
12. Austroads, *Bicycles*. Guide to Traffic Engineering Practice. Vol. 14. 1993: Austroads. 125.
13. Austroads, *Motorcycle safety*. Guide to Traffic Engineering Practice. Vol. 15. 1999: Austroads. 49.
14. Wigan, M.R., *Motorcycle Advisory Council Workshop*. 1999, VicRoads: Melbourne. p. 2.
15. Wigan, M.R., *Consultation for motorcycle measures*. 2000, VicRoads: Melbourne. p. 2.
16. Wigan, M.R., *Road markings and slippery surfaces*. 2000, VicRoads: Melbourne. p. 2.
17. Wigan, M.R., *Loose surfaces and motorcycles*. 2000, VicRoads: Melbourne. p. 2.
18. Wigan, M.R., *Designing for the unexpected*. 2000, VicRoads: Melbourne. p. 2.
19. Wigan, M.R., *Designing for motorcycle clearances*. 2001, VicRoads: Melbourne. p. 2.
20. FHWA, *Pedestrian /Bicycle Safety Resource Set*. 2000, Federal Highway Administration USDoT: Washington DC. p. CDRom.
21. Transport Research Centre, *The VATS Process: 1998 Release 2*. 1999, RMIT: Melbourne.
22. Wigan, M.R., *Bicycle ownership, use and exposure in Melbourne 1978-9*. 1983, Australian Road Research Board: Vermont, Victoria.

23. Wigan, M.R., *Bicycle ownership use and exposure participation and activity patterns in Melbourne, Australia.* Transportation Research A, 1984. 18(5/6): p. 379-398.

6 APPENDIX: MOTORCYCLE LANE CRITERIA

D. One important measure that the Ministry, Malaysian Highway Authority (MHA) and PWD are implementing is the exclusive motorcycle lane policy. The PWD and MHA will provide motorcycle lanes where the situation and conditions merits it. The interim motorcycle lane guidelines stipulates the following:

1. Daily Motorcycle Traffic

· Expressway - greater than 15% daily traffic volume

· Other Roads - greater than 30% daily traffic volume

2. Overall Traffic Volume

· 2 way, 2 lanes - > 16,000 Average Annual Daily Traffic (AADT)

· 2 way, 4/6 lanes - greater than 48,000 AADT

· Expressways - greater than 48,000 AADT

3. Speed Environment

· Speed environment less than 80 km/h (urban areas) multiply AADT by 1.

· Speed environment greater than 80 km/h (rural areas) multiply AADT by 0.75.

4. Motorcycle accident rate

· If motorcycle accident rate is higher than other vehicle accident rates, then consider building special motorcycle lane.

If any of the three criteria above is satisfied, then the relevant authority may build the special motorcycle lane along the identified route.

E. Further to the motorcycle lane policy, the PWD is on a maintenance programme of paving road shoulders up to a minimum 1.5 m width on the Federal Road network. This facility is not considered as an exclusive motorcycle lane but as providing improved and safer road surface characteristics for the convenience of motorcyclists and pedestrians alike.

F. The ministry has adopted a “Zero Pot Hole” policy where the intention is to provide improved quality of the riding surface. This is to cater to increased expectation levels from road users for better riding comfort and more safer especially for motorcyclists.

Extract from [11]