Motorcycles: A growing dot on the transport policy radar?

Geoff Rose
Institute of Transport Studies (Dept of Civil Engineering)
and Monash Sustainability Institute
Monash University

1. Introduction

Transport policy is increasingly being framed in the context of sustainable mobility with issues of congestion, injuries and loss of life from road crashes, local air quality, climate change, energy availability and security and the vitality of our urban areas all of concern. The growth in use of personal motorised vehicles represents a challenge when seeking to advance sustainable mobility which is likely to require a fundamental shift in transport policy settings (Toleman and Rose, 2008). While the spotlight of sustainable mobility has focussed attention primarily on motorcars and public transport, other types of vehicles, specifically motor scooters and motorcycles, have received limited attention.

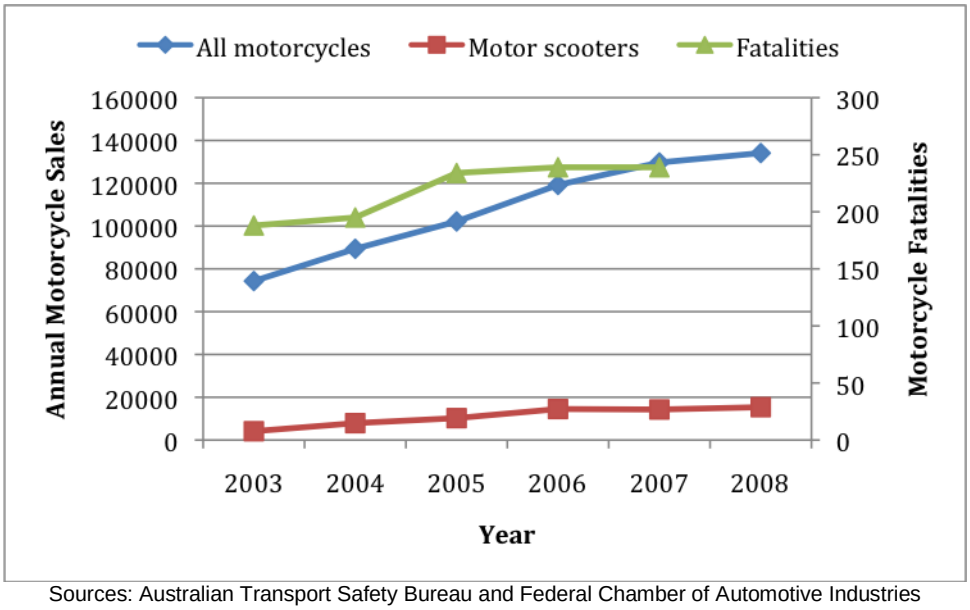
While traditionally viewed as a road safety problem, awareness is growing of the potential that motorcycles[1] present to advance a range of transport policy objectives such as reducing congestion, enhancing accessibility and reducing emissions (Department for Transport, 2005). This paper seeks to examine the relevance of motorcycling to achieving key transport objectives, and identifies the range of initiatives which could facilitate motorcycling as a viable travel choice within the mix of personal transport options.

The paper is structured as follows. Recent trends and current issues are reviewed in Section 2. The strategic fit of motorcycles in the context of transport strategy is then examined in Section 3. Section 4 outlines a range of strategy measures which could be employed as part of a comprehensive motorcycle safety and mobility strategy. Finally, the conclusions of the paper are presented in Section 5.

2. Trends and current issues

In recent years motorcycle sales have grown substantially in Australia (Figure 1). Within this vehicle segment motor scooters have grown as a proportion of total sales from 6 per cent in 2003 to a peak of 12 per cent in 2006 (FCAI, 2009). The rise in the number of these vehicles has been matched by corresponding growth in the number of motorcycle deaths.

[1] The term motorcycle is used generically in this paper to refer to motor scooters and motorcycles



Sources: Australian Transport Safety Bureau and Federal Chamber of Automotive Industries

Figure 1: Trends in Australian motorcycle sales and fatalities

Recent sales figures, reflecting a decline in the economy, have indicated a fall in the sales numbers with total sales for the six months to June 2009 down 14 per cent over the corresponding period in 2008 (FCAI, 2009). While scooter sales have shown the sharpest decline (down 29 per cent over the corresponding six month period in 2008) they still represent 10 per cent of sales in this vehicle class. The Federal Chamber of Automotive Industries Chief Executive, Andrew McKeller is quoted as saying that lower petrol prices account for much of the drop-off in motorcycle sales (Lucas, 2009).

The casualty crash risk of motorcycle riders is up to 17 to 20 times that of car occupants (Christie and Newland, 2001), however, there is evidence that safety improves with higher use (Harrison and Christie, 2005). Recreational motorcycle riding, particularly in rural areas is predominantly a concern from a road safety perspective (Johnston et al, 2008). There is also a growing concern over older “returning” riders who take up riding again after purchasing a large, powerful motorcycle (Christie and Newland, 2001). There is disagreement in the literature over the relative crash risks of mopeds and scooters compared to motorcycles (Haworth et al, 2009).

Energy use and environmental impacts are increasingly coming under the spotlight. Little is known about how the energy use and emissions of motorcycles compares to motor vehicles (Vasic and Weilenmann, 2009). Unlike motor vehicles, exhaust emissions of motorcycles are currently unregulated in Australia despite concerns over both local air quality impacts, associated with emissions of HC and NOx, as well as global climate change impacts linked to CO2 emissions. Anecdotal comments suggest that where motorcycles are fitted with devices to reduce emissions of air pollutants, those devices are often removed in order to improve performance and fuel efficiency. Noise emissions are regulated via Federal standards in Australia although there is evidence overseas (California Air Resources Board, 2009) of

high rates of after sales modifications to P2W vehicles that undermine noise and air quality regulations.

3. Assessing Strategic Fit

In many cities, the strategic framework for transport planning involves:

- a Statement of Vision: this is a broad statement of the desired end point, usually framed in terms of the character of the city and perhaps transport's role in creating that city
- identification of objectives: these identify the desired direction for the transport system consistent with the vision
- specification of targets: these are intermediate points to be hit along the way to take the city towards the vision as articulated in the strategy and
- nomination of actions: these are the steps to be taken to advance the strategy.

Within the context of sustainable transport strategies being prepared throughout the world, motorcycles rarely feature prominently. While some exceptions will be noted shortly, motorcycles tend to get greatest attention in the content of road safety strategies where actions are identified to reduce the incidence of fatalities and serious injuries associated with motorcycle use. Road trauma is recognised as an unsustainable outcome of current transport system operations that has adverse economic and social impacts.

While considerable effort is directed at seeking to improve the safety performance of motorcycling, the mobility advantages of the mode have received limited professional attention. This raises the question of whether motorcycling is relevant in the context of achieving broader objectives being set by Governments for the transport system. We can begin to answer that question by assessing the strategic fit between motorcycling and the objectives or priorities reflected in transport strategies.

Clearly motorcycle safety will remain a key area of attention in any government initiatives that may simultaneously seek to address the broader mobility opportunities associated with motorcycling.

In assessing strategic fit it is appropriate to acknowledge that not all types of 'motorcycles' or trip purposes may have equal relevance to achieving core transport objectives.

The term motorcycle is broad and consideration needs to be given to a range of powered two/three wheel vehicles covering at least the spectrum from mopeds and scooters to motorcycles but also potentially covering the boundary with the powered bicycle (Oxford Systematics, 2005). Within that broad range of technologies, a distinction could also be drawn on the basis of the power source with differentiation between petrol versus electric powered vehicles. Those technology distinctions are potentially important in terms of emissions and the sustainability of the source of power that can be linked to objectives relating to air quality, pollution and energy security.

In addition to drawing a distinction by vehicle type, it is appropriate to acknowledge that this class of vehicle can be used for a variety of trip purposes. When characterising the purposes of motorcycle trips we can distinguish utilitarian riding (e.g. for commuting, shopping etc.) from recreational riding (in urban or country areas) or off-road recreational use. Not all trip purposes are necessarily aligned with core transport objectives. Important considerations will include where and when the trip is undertaken. For example, commuting by motorcycle as opposed to driving a motor vehicle could help to reduce congestion and emissions and thereby deliver important outcomes in terms of economic productivity and air quality. It is noted that some motorcycle models may produce higher emissions than a motor vehicle (Environment Protection Authority, 2003) and so the actual outcomes will depend on the nature of the vehicles considered.

Transport policy might seek to employ measures that target particular technology types or trip purposes rather than aiming to stimulate or manage all types of these vehicles and trip purposes in the same way. This means that a transport policy/strategy might target some of the cells in Table 1 because that use aligns with achieving the objectives set for the transport system. Other cells in Table 1 may not be considered in a transport policy/strategy because they do not help to deliver key outcomes.

Table 1: Classification of different vehicle type and trip purpose combinations

		Technology (Vehicle type, engine/motor size and power source)		
		Moped	Scooter	Motorcycle
Trip Purpose	Commuting			
	Shopping			
	Social			
	Recreational riding: urban			
	Recreational riding: rural			
	Recreational riding: off-road			

Motorcycle use is potentially relevant to achieving a range of key outcomes that are aligned to common objectives which transport strategies seek to progress. Those outcomes, and the relevance of motorcycle use in the context of each, are as follows:

- Improving transport system efficiency: The smaller spatial footprint of motorcycles provides opportunities to reduce road space use and congestion as well as improve utilisation of land devoted to parking

- Improving safety: Higher risks relative to other modes and this represents an area of concern in the context of motorcycle use. There is a need to manage interaction with other vehicles and road users specifically pedestrians and motor vehicles
- Reducing use of non-renewable energy: Potential for reduced energy consumption per passenger kilometre travelled, relative to motorcars, along with potential to make greater use of renewable energy (green energy recharging for electric P2W)
- Reducing environmental impacts: Potential to reduce GHG emissions and other pollution per passenger kilometre. Noise problems arising from motorcycle use are over-represented relative to their share of the motor vehicle fleet.
- Maximising accessibility and mobility benefits: Ease of parking can improve access to activities, while lower capital and operating costs can mean that this form of motorised mobility is available to travellers with limited incomes for access to work or education. Motorcycles may therefore have a role in enhancing social inclusion.

Existing strategies that deal with motorcycles focus almost exclusively on the road safety dimension. Examples include the Victorian Motorcycle Road Safety Strategy (Vic Roads, 2002) and the Queensland Motorcycle Safety Strategy (Department of Transport and Main Roads, 2009). Exceptions include strategies released in the UK and Sydney that address motorcycles more holistically in the context of transport strategy. Those strategies are reviewed briefly below.

In 2005, the UK government released its motorcycling strategy (Department for Transport, 2005) which articulated a vision to:

> "facilitate motorcycling as a choice of travel within a safe and sustainable transport framework."

Reflecting the framework introduced above, the UK strategy focuses on on-road motorcycling with an emphasis on utilitarian rather than recreational use. While recreational use may change in response to the policy instruments outlined in the UK strategy which primarily target utilitarian travel, that is essentially a secondary effect and not a primary priority. The UK strategy also refers to different 'styles' of motorcycle, specifically motorcycles, scooters and mopeds although the term 'motorcycle' is used in a generic sense throughout the document.

The UK national strategy is supported by many county motorcycle strategies (e.g. Warwickshire, undated; Derbyshire, 2004; Bedfordshire County Council, 2006; Nottingham County Council, 2007 a and b; Surrey County Council, 2007) that follow the lead of the national strategy in seeking to progress both mobility and safety considerations in relation to this mode.

The City of Sydney (2008) released a 'Motorcycle and Scooter Strategy and Action Plan' that highlights the benefits which these vehicles offer in terms of the three pillars of sustainability:

- Social –provide enjoyable, convenient and low cost accessibility in the city
- Environment - lower greenhouse emissions (relative to cars) per passenger kilometre and lower space requirements for parking
- Economic –in terms of congestion, land use and travel costs.

In articulating a way forward the City of Sydney Strategy highlights a number of areas for priority action:

- Parking – including residential, visitor, off-street, courier and footpath parking
- Enhancing sustainability by promoting stringent emissions standards and encouraging hybrid and electric scooters
- Security – specifically security of parking both on and off-street
- Advocating for a more equitable and convenient tolling arrangement for motorcycles
- Safety – designing facilities for safety and exploring training opportunities in conjunction with the state road authority.

The recently released Victorian Transport Plan (State of Victoria, 2008, pp. 113) notes the Government is currently working on "improved safety, awareness and parking for motorbikes and scooters …. (to) …. encourage greater use of these lower carbon forms of transport."

These examples highlight the broad relevance of motorcycling in the context of transport policy. In a strategic sense, a package of measures must be selected to progress the desired objectives. The range of available measures is examined in the following section.

4. Strategy Measures

A range of strategy measures could be directed at influencing the role which motorcycles play in the transport mix. One valuable reference point is the Geelong Bike Plan (Geelong Bike Plan Committee, 1984), still recognized as an outstanding example of comprehensive bicycle planning, which introduced the notion of the 4E's of bicycle planning: Engineering, Education, Encouragement and Enforcement.

Those categories are also relevant in the context of motorcycle transport planning and are therefore reflected in Table 2 that serves as a summary of the potential motorcycling strategy measures. In addition to the 4 E's mentioned earlier, another category of 'Pricing' is added consistent with the categorization of travel demand management measures articulated by Wayte (1991). Table 2 identifies the associated outcomes (as discussed in the previous section) which could be progresses through application of measures in each strategy area. The table also highlights that there is scope for all levels of government in Australia to use a range of policy instruments to promote motorcycling as a potential part of a sustainable transport system. We will now examine this broad range of strategy measures and note examples of their application.

Table 2: Identification of potential strategy elements

			Government Relevance		
Strategy Area	Related outcomes	Potential focus/initiatives	Fed.	State	Local
Pricing	• Improving system efficiency • Improving safety • Reducing use of non-renewable energy • Reducing environmental impacts • Maximising accessibility and mobility benefits	Ownership Use • Registration • Insurance • Levies • Tolls Parking	✓	✓ ✓ ✓ ✓ ✓ ✓	 ✓
Engineering	• Improving system efficiency • Improving safety • Reducing use of non-renewable energy • Reducing environmental impacts	Vehicles • Vehicle design to improve safety and comfort • Engine design to reduce emissions and noise pollution Rider Equipment • Improved clothing and equipment for safety and comfort Infrastructure • Pavement and road furniture • Intelligent Transport Systems • Parking • End of trip facilities Traffic Management • Advanced stop lines • Use of bus lanes • Use of HOV lanes on freeways	 ✓ ✓ ✓ ✓	 ✓ ✓ ✓ ✓ ✓ ✓	 ✓ ✓ ✓ ✓ ✓
Education	• Improving system efficiency • Improving safety • Reducing use of non-renewable energy • Reducing environmental impacts	• Pre-purchase education • Rider training • Eduction of other road users		✓ ✓ ✓	
Encouragement	• Improving system efficiency • Improving safety • Reducing environmental impacts	• Use of role models – Voluntary travel behaviour change • Promotion of positive image in print and electronic media • Sponsorship of events to promote safe use		✓ ✓ ✓	✓ ✓ ✓
Enforcement	• Improving safety • Reducing environmental impacts	• Targeting licensing, speed, riding under the influence along with noise and emissions		✓	

4.1 Pricing

Pricing policies or measures can target ownership or use. Taxes or subsidies can be used to either encourage or discourage purchase of different types of vehicles. Some cantons in Switzerland offer subsidies to increase ownership of electric mopeds and scooters (Swiss Association for Electric and Efficient Vehicles, 2003) while surtaxes have at times been applied in other parts of Europe to discourage use or ownership of different types of motorcycles (Oxford Systematics, 2005). In terms of use, pricing policies can affect fixed costs (registration, insurance and levies) as well as operating costs such as tolls or road use fees and parking charges. Motorcycle riders are exempt from the congestion charge operating in London and on the CityLink tollway in Victoria motorcyclists do not currently pay tolls. Footpath parking in Melbourne offers a no-cost parking option for motorcycle users.

Prices can certainly influence behaviour and can be used to either encourage or discourage use. They can have other implications. For example, the absence of tolls on a motorway can encourage motorcyclists to use that facility thereby producing a personal and community benefit from operating on a facility where motorcyclists are likely to face a lower crash risk (Oxford Systematics, 2005). Recent research from the UK (Norland, 2007) suggests that the incentive to use motorcycles, produced by their exemption from the London congestion charge, could explain why there has been an increase in motorcycle trips within the London Congestion charging zone of about 15 per cent. While there appears to be a drop in monthly casualties in the congestion charging zone since the charge was introduced, other parts of London have experienced an increase in motorcycle casualties. This highlights the challenge of making the most of the mobility opportunities presented by motorcycling while balancing the safety outcomes.

4.2 Engineering

The term ‘Engineering’ covers a range of strategy initiatives, covering vehicles, rider equipment, infrastructure and traffic management.

On the vehicle front, this could include more active crash protection, like the BMW C1 roll-cage protected scooter or use of advanced technology (termed Intelligent Transport Systems) to provide added safety measures. The BMW C1 motor scooter (Figure 2), which was sold in Europe, employed in-built passive safety systems including a full seat with headrest and seatbelt. This meant that in several EU member states it could be driven without a helmet.

One innovation gaining prominence is the use of alternative fuel sources with interest in hybrid power as well as alternatives to fossil fuels. These in part amount to attempts to reduce emissions, particularly for overseas manufacturers with a strong European presence. Examination of emission standards for motorcycles in the USA (Environment Protection Authority 2003) has highlighted that some vehicles in this category produce more emissions per kilometre than a motorcar such as a medium size four wheel drive vehicle. There is scope for improvements in engine design including use of fuel cells and orbital engines (Oxford Systematics, 2005) to reduce not only emissions but also to reduce reliance on non-renewable fuels.

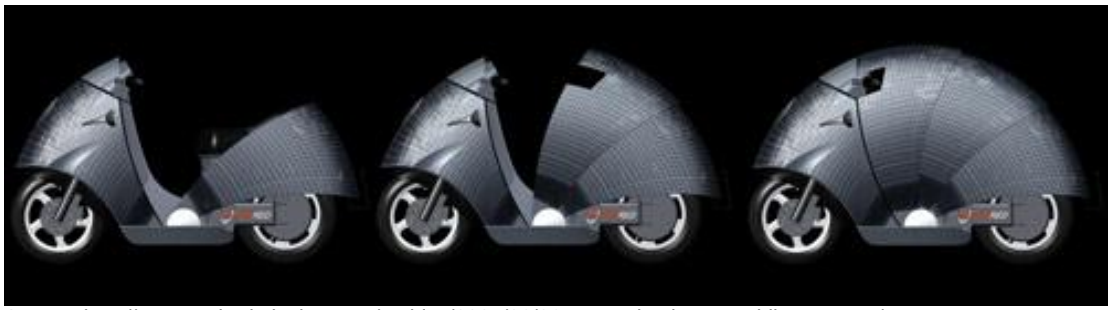
Source: farm4.static.flickr.com/3220/2596938049_6bf53e6ee2.jpg?v=0

Figure 2: BMW C1 motor scooter

The Vectrix electric scooter produces no on-road emissions (Figure 3). While still a prototype vehicle, the Sun Racer (Figure 4) represents a particularly interesting innovation in an electric motor scooter. The body is covered in solar panels. When the vehicle is parked a cowling is folded over the seat to increase the solar capture area and enable the vehicle to recharge its batteries.

Source: www.motorcycle-usa.com/photogallerys/2009_Vectrix-VX-1E.jpg

Figure 3: Vectrix Electric Scooter



Source: http://www.carbodydesign.com/archive/2007/06/26-sun-red-solar-motorbike-concept/

Figure 4: Sun Racer solar motorbike

Apart from the innovations in relation to power sources, there has been some development with three-wheel motorcycles such as the Spyder (Figure 5). This configuration provides inherent stability to the vehicle when stationary but has obvious implications for the space envelope required particularly for parking.

Source: www.besportier.com/archives/2008-brp-can-am-spyder-grand-sport-roadster.jpg

Figure 5: Cam-Am Spyder three-wheel motorcycle

Building on the concept of a three wheeled vehicle, efforts overseas are being focussed on the development of enclosed three wheel vehicles. While they offer many comfort and convenience attributes commonly associated with a car, they are likely to fall into the motorcycle category in a number of overseas jurisdictions. Of particular relevance is the Carver (Figure 6a), until recently produced in Europe and on the road in New Zealand; Clever (Figure 6b), a natural gap powered vehicle, being developed by a group including BMW as an obvious extension to the C1; and the Aptera (Figure 7), an electrically powered three wheel vehicle. The Aptera is scheduled to enter production in US in late 2009 and the developers believe it fits the classification of a motorcycle. That classification, combined with its electric drivetrain, will make it legal to be driven as a single occupancy vehicle in California's carpool lanes (Woodyard 2008). The motorcycle classification has implications for the development of the vehicle with Aptera's CEO (Mr C Fambro) quoted in Woodyard (2008) as saying that 'The testing and red tape required to market a motorcycle is less rigorous than for a four-wheel car. It allows us to leapfrog into the market'. This also raises the issue of occupant safety given the absence of vehicle crashworthiness requirements under a motorcycle classification.

There is also scope for other engineering–based supply-side measures targeting the vehicle and rider equipment (Department for Transport, 2005, pp. 20). The UK strategy explicitly refers to the role of technology in primary safety, by preventing accidents happening, as well as in secondary safety, by reducing the degree of injury when accidents happen (through use of protective equipment such as helmets, clothing etc.) (Department for Transport, 2005, pp. 20).

(a) Carver (b) Clever concept vehicle

Source: http://www.carver-worldwide.com/Home/Index.asp?nc=1 and www.clever-project.net

Figure 6: Three-wheel leaning vehicles

Source: www.aptera.com

Figure 7: Aptera three-wheel vehicle

Adequate infrastructure can ensure not only a safe space to ride but there are also more 'micro' level issues such as pavement surface quality and the type and placement of roadside furniture. The UK strategy notes the importance of these issues in the context of on-going infrastructure maintenance (Department for Transport, 2005, pp.15). Parking provision is another policy option where issues include the security of the parking that is provided along with amount and distribution of that parking (in both public and private space) (Department for Transport, 2005, pp 16). Parking provision can also be used to facilitate multi-modal journeys (Department for Transport, 2005, pp 17) and thereby encourage public transport use.

In terms of traffic management, a key consideration is road space management with options including allowing motorcycles to use advanced stop lines (Department for Transport, 2005, pp 18), bus lanes (Transport for London, undated) or High Occupancy Vehicle (HOV) lanes (Jernigan and Lynn, 1995). These measures can improve rider safety and also produce travel time savings which can encourage greater use of the mode.

4.3 Education

Education can be directed at the riders (potential, novice, existing or returning) through for example, improved rider training, or it can be directed at other road users to increase their awareness of motorcyclists, their

vulnerability and need for visibility. Education can also target the issue of motorcycling culture (Department for Transport, 2005, p25) through exploring the rights and responsibilities of riders and other road users and fostering a climate of mutual respect.

Education can start early through dissemination of information about factors to consider in motorcycle purchase decisions as well as learning about the value and options available in terms of protective clothing and rider training. Education can also be facilitated through the provision of information on usage levels and relative safety risk – ideally segmented by vehicle type – e.g. mopeds versus scooters versus motorcycles. The UK Motorcycling strategy also notes the potential for education in the school curriculum (Department for Transport, 2005, pp 34).

4.4 Encouragement

Encouragement can be undertaken as part of voluntary travel behaviour change programs such as TravelSmart where the motorcycle could be promoted as a commuting alternative to the car along with walking, bicycling, carpooling and public transport. Travel plans developed for workplaces as part of a TravelSmart campaign could provide a basis for identifying local measures that would assist staff commuting by motorcycle. In addition to this, the UK strategy notes the potential for motorcycles as an alternative pooled vehicle for work travel during the day (Department for Transport, 2005, pp.18).

Encouragement can also come from using experienced riders as role models to promote safe and responsible motorcycling. There would also be scope to work with the media to promote positive images of motorcycle use in print and electronic media – as noted in the UK Motorcycling strategy (Department for Transport, 2005, pp 36). Governments can also play a more explicit advocacy role through sponsoring or organising events in much the same way that they do for bicycling (e.g. Ride to Work Day).

4.5 Enforcement

Speed and alcohol are commonly cited as causal or contributing factors in motorcycle crashes (Bayly et al, 2006). Since those factors can be targeted through enforcement, it is inconceivable that enforcement would not be an essential element of any transport strategy that aimed to improve safety for motorcycle riders and other road users. In some jurisdictions, unlicensed riders can also contribute to higher crash rates and result in focussed enforcement campaigns (Washington State Patrol, 2008). Noise emissions, particularly from some styles of motorcycle, can be a concern to the community and lead to targeted enforcement activity (Boston Globe, 2009).

5. Conclusion

This paper has identified an alignment between motorcycling and a number of key outcomes that government transport policies seek to progress. While examples are limited, there is a clear indication, at least from the UK, Sydney and Melbourne, that the mobility opportunities presented by motorcycles are

beginning to be recognised without losing sight of the importance of improving the safety of motorcycling.

A review of initiatives identified a range of potential policy measures that could be packaged to influence the role of motorcycling in the transport mix. Those policy measures can be classified under the headings of Pricing, Engineering, Education, Encouragement and Enforcement.

While this study has provided some preliminary insight there is no doubt that additional research will be required to provide the evidence-base needed for formulation of comprehensive policies. The challenge lies in balancing the mobility opportunities with the safety vulnerability of motorcycles so they can contribute to the development of a safe, sustainable transport system. These vehicles certainly appear to show every indication of becoming a larger dot on the transport policy radar in the years ahead.

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