

Infrastructure improvements to reduce motorcycle crash risk

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Abstract

This paper introduces a selection of the technical findings under Austroads safety program project ST1870, which sought to identify effective infrastructure improvements to reduce motorcycle crash risk and crash severity, based on how riders perceive, respond and react to infrastructure they encounter.

The project commenced with a literature review of national and international guides, publications and research papers commenced the project, which also enabled the identification of knowledge gaps and areas where further detail was required.

A crash analysis was undertaken to demonstrate the relationship between motorcycle crashes, travel period, vehicle configuration (i.e. motorcycle only and multiple vehicle crashes involving a motorcycle), road geometry, road layout (e.g. intersection type) and crash types. For comparative purposes, vehicle crashes at the same location were also analysed.

Explanations of why, and how, road infrastructure elements influence motorcycle crash risk were researched and are provided within this paper. This primarily involved identifying how the design and condition of road infrastructure elements can influence either the likelihood of a crash occurring or the resulting severity of a crash. Where a number of elements that would increase the likelihood or severity of a crash were present concurrently, the proportionate increase in risk was demonstrated using the AusRAP model.

The study has built up a compendium of treatments, presented in such a way that engineering decisions to manage these elements can be justified, even if outside of existing design warrants, and asset management and maintenance practice.

The research highlights that motorcycles should be identified as an individual road user group and considered as a 'design vehicle' during road design and asset management and maintenance practices.

It is concluded that motorcycle crash risk can be managed, but requires changes in practice, in design, asset management funding and routine maintenance performance contracts. One example is in the identification of road sections and/or routes that pose the highest crash risk to motorcyclists, so that they can be managed and maintained appropriately. In addition, the author advocates proactive motorcycle specific network safety assessments and road safety audits, as well as fine tuning in design parameters for roads carrying significant volumes of motorcyclists (e.g. horizontal geometry, sight lines, lane and shoulder width, intersection types, intersection quality and controls). It is also suggested that the range and detail of mitigation measures be expanded.

Introduction

Motorcycle crashes are a significant contributor to deaths and serious injury on our roads. As outlined in the Australian Transport Council's National Road Safety Strategy, in Australia, motorcycle riders made up 16 % of all fatalities in 2012, and 22 % of serious injury casualties despite representing only a very small percentage of total traffic volume (one per cent of VKT). The rate of motorcyclist deaths per registered motorcycles is five times higher than the rate of occupant deaths per registered 4-wheeled vehicle. In recent years a clear upward trend in motorcycle crashes was identified in Australia and New Zealand.

This paper describes an investigation into the relationship between motorcycle crashes and road infrastructure, and specifically, how road infrastructure influences both the likelihood of such a crash occurring and its severity.

The investigation included: a comprehensive literature review, crash analysis, the identification of road infrastructure elements as crash factors, the identification of effective mitigation measures and their likely safety benefit and consultations with stakeholders. An Austroads report will be the ultimate output of the project (at the time of writing, publication was expected before the end of 2015).

Objectives and Outcomes

The objectives of the project were to:

- determine the influence of road infrastructure elements in motorcycle-related crashes,
- identify countermeasures that have the potential to reduce the incidence and/or severity of such crashes.

Road infrastructure elements considered included design parameters (e.g. horizontal alignment, superelevation), road surface condition (including skid resistance), roadside hazards and overall maintenance condition.

The project is focused on providing guidance to practitioners, including potential updates to the Austroads Guides to Road Design, Traffic Management, Road Safety and Asset Management. It is also hoped that the project will contribute to several of the objectives within the Australian National Road Safety Strategy 2011-2020, including safety improvements on popular motorcycle routes (a specific action for the first three years of the strategy) and provide advice ahead of plans to introduce motorcycle black spot/black length programs in all jurisdictions (a 'future' action).

Method

The project comprised of 7 main tasks:

- Task 1: Literature review and internet searches - to identify if similar studies have been undertaken and to review any publications related to motorcycle crashes or treatments or strategies implemented by other road agencies.
- Task 2: Crash analysis of passenger vehicle and motorcycle crashes (2001-2010) in Australia and New Zealand on state controlled roads - to compare passenger vehicle and motorcycle crashes by travel period (commuting and recreational) by road feature (midblock – straight/curve, intersection type).

- Task 3: Identification of road infrastructure as a crash factor in motorcycle crashes - using existing motorcycle safety publications from Australia and New Zealand, Europe and America, as well as findings from motorcycle specific road safety audits undertaken in Australia.
- Task 4: Recommendation of mitigation measures - based on the findings of Task 3 and discussed and confirmed with stakeholders.
- Task 5: Stakeholder consultation - with the Australian Motorcycle Council, state motorcycle advocacy groups, iRAP, and practitioners within road design, road safety, finance, road operations, network programs, asset management and maintenance road engineering disciplines of state road agencies across Australia and New Zealand.
- Task 6: Review of current Austroads Guides - to identify if technical guidance was provided for motorcycles and if that guidance would reduce motorcycle crash risk, recommendations were made to update a guide where required.
- Task 7: Safety benefit analysis – assess the effects of treatments outlined in the mitigation measures using an AusRAP assessment, on an existing road, with known motorcycle crash history.

Results

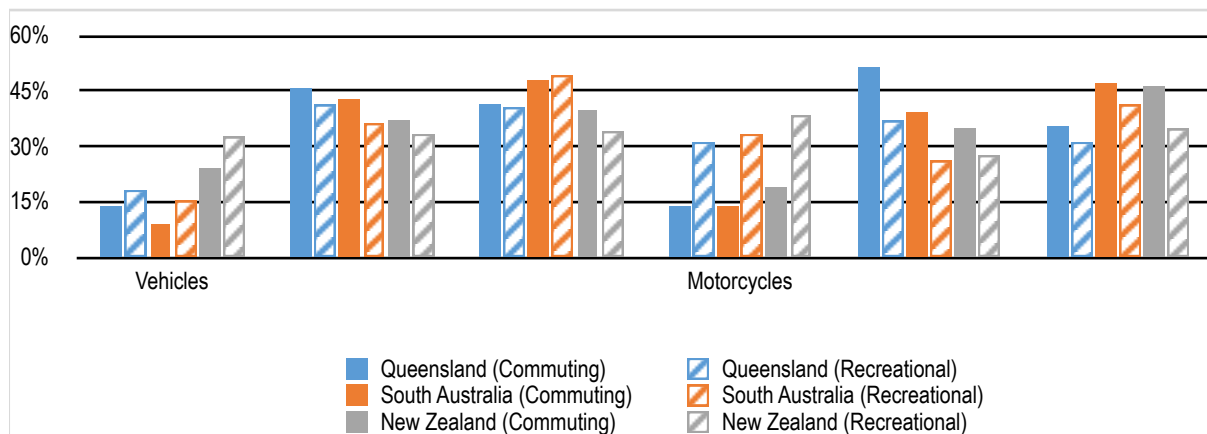
Literature Review

A literature review of 34 national and international research and motorcycle guidance publications was undertaken, these range from publications by the Federation of European Motorcyclists' Association (FEMA 2012), *EuroRAP Barriers to change* (EuroRAP 2008), *Safer journeys for motorcycling* (NZ Transport Agency 2012) and *Making roads motorcycle friendly* (VicRoads 2014). The literature confirmed that road infrastructure contributed to crash likelihood and severity, predominantly with regards to poor pavement condition, the presence of hazards on the road surface, reduced/poor horizontal sight lines, and the presence of roadside impact hazards (including safety barriers).

It was apparent that, of the publications reviewed, the intent was to provide a practical guide (mainly based on experience), as opposed to providing technical guidance to justify engineering decisions. Typically, the literature did not systematically identify all of the elements of road infrastructure that influence motorcycle crash risk, or the risk factor for each element, or more significantly, the resulting risk when a number of elements are concurrent (combined).

Crash Analysis

The crash analysis identified that the incidence of motorcycle crashes at intersections, or on a curve or a straight varies according to the travel purpose (*Figure 1*). A travel purpose is defined as commuting (weekdays) and recreational (weekends and public holidays). It was demonstrated that motorcycle crashes on curves, straights and at intersections vary by travel time, more so than vehicle crashes, particularly on curves and at intersections.

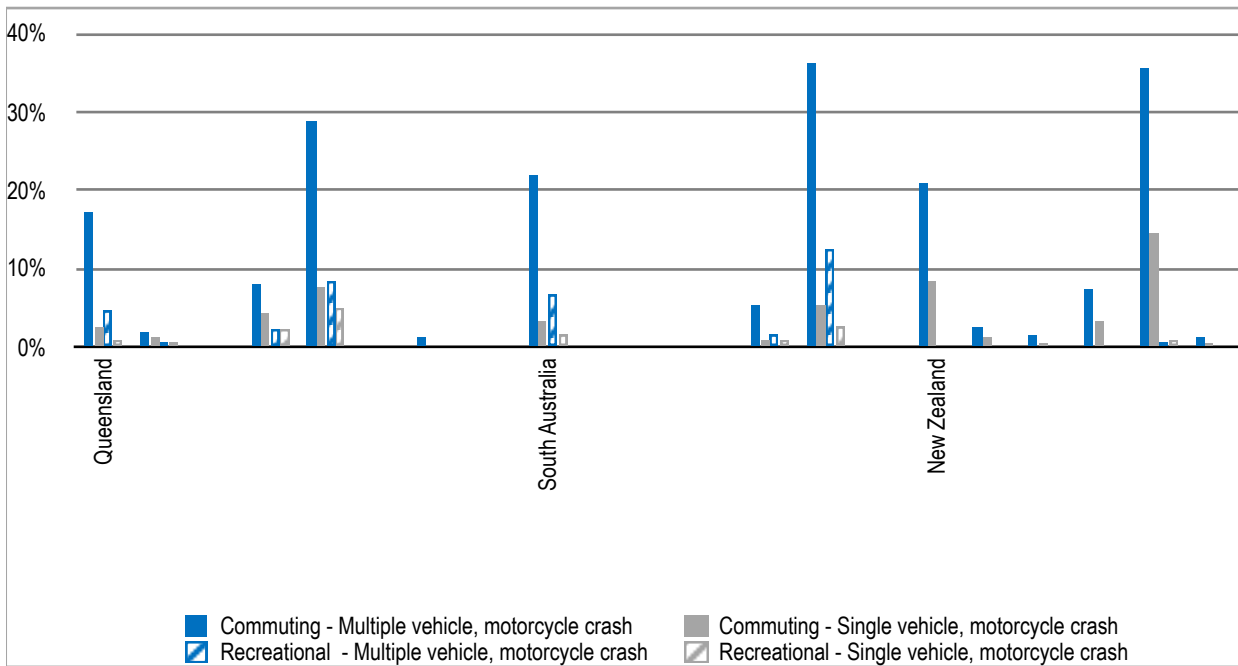


Note: Crashes are distributed by the number of vehicle or motorcycle crashes in each state, in each travel period. The crashes shown for each travel purpose in each state, in total equal 100%

Figure 1. Comparison of vehicle and motorcycle crashes by road feature and travel purpose

It was found that:

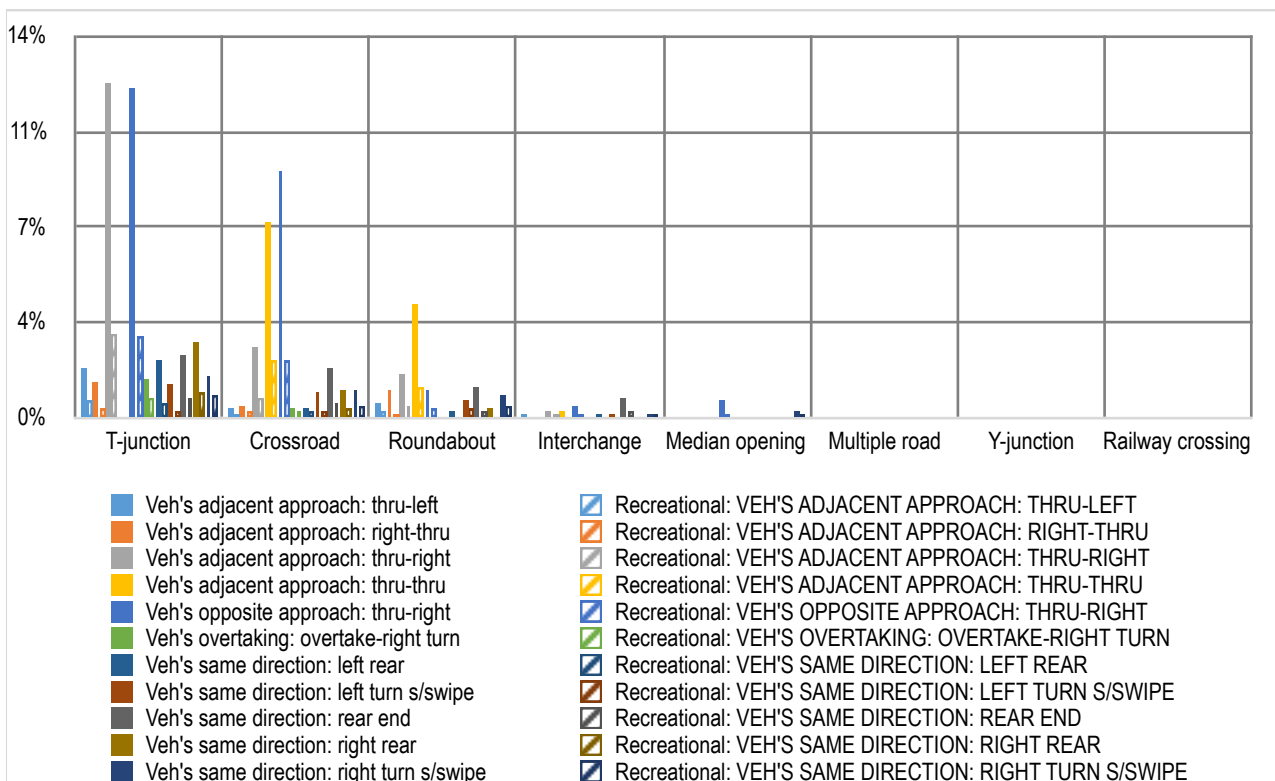
- The majority of crashes occurred in the commuting period (64% average).
- A higher proportion of crashes occurred on curves during the recreational period.
- A higher proportion of crashes occurred on straights and at intersections during the commuting period.
- The proportion of crashes involving a motorcycle on a curve was higher than the proportion of crashes involving only passenger vehicles, and this was particularly evident for multiple vehicle, motorcycle only, crashes during the recreational period.
- The majority (95% average) of motorcycle crashes at an intersection occurred at a T-junction (50% average), crossroad (33% average) and roundabouts (12%), these crashes were also influenced by travel period (**Figure 2**).
- The number of crashes at a T-junction is significant, particularly given the reduced number of conflict points at T-junctions compared to a cross-intersection. It is suggested that the less complex driving task at T-junctions may result in a more relaxed driver behaviour, namely when checking for a safe gap in traffic to turn through the intersection. This combined with a vehicle driver not identifying the presence of a motorcyclist ('looked but failed to see'), may contribute to the high proportion of multiple vehicle crashes involving motorcycles at T-junctions, this is also relevant to cross-roads and roundabouts.



Note: Crashes are distributed by the number of motorcycle crashes at intersections in each jurisdiction, the crashes shown for each state in total equal 100%

Figure 2. Distribution of motorcycle intersection crashes by intersection type and travel purpose

At intersections it was found that the highest proportion of crashes were multiple vehicle crashes involving a motorcycle. The prominent crash types were; vehicle adjacent approach (thru-right), opposite approach (thru-right) and adjacent approach (thru-thru). Queensland crash codes were utilised for this part of the project (i.e. intersection crash codes for each jurisdiction were converted to allow a direct comparison).



Notes:

- Crashes are distributed by intersection type, and travel period. All crashes in this graph equal 100%.
- The solid line represents the commuting period and the hatched line represents the recreational period.

Figure 3. Distribution of motorcycle crashes at key intersection types by crash description (converted to Queensland crash codes)

Identification of road infrastructure as a factor in motorcycle crashes

Road infrastructure safety issues were collated from Australian, New Zealand, European and American publications. Road design and road safety engineering concepts were also considered, resulting in a number of additional issues being identified.

The investigation identified how each road infrastructure element can influence motorcycle crash risk (the likelihood of a crash occurring and the severity of a crash if it occurs), on midblock sections of road or at intersections.

It was found that each road infrastructure element presents a unique level of crash risk, with the level determined by/dependent upon how the element was originally designed and its condition (i.e. if it had been maintained to its original design standard).

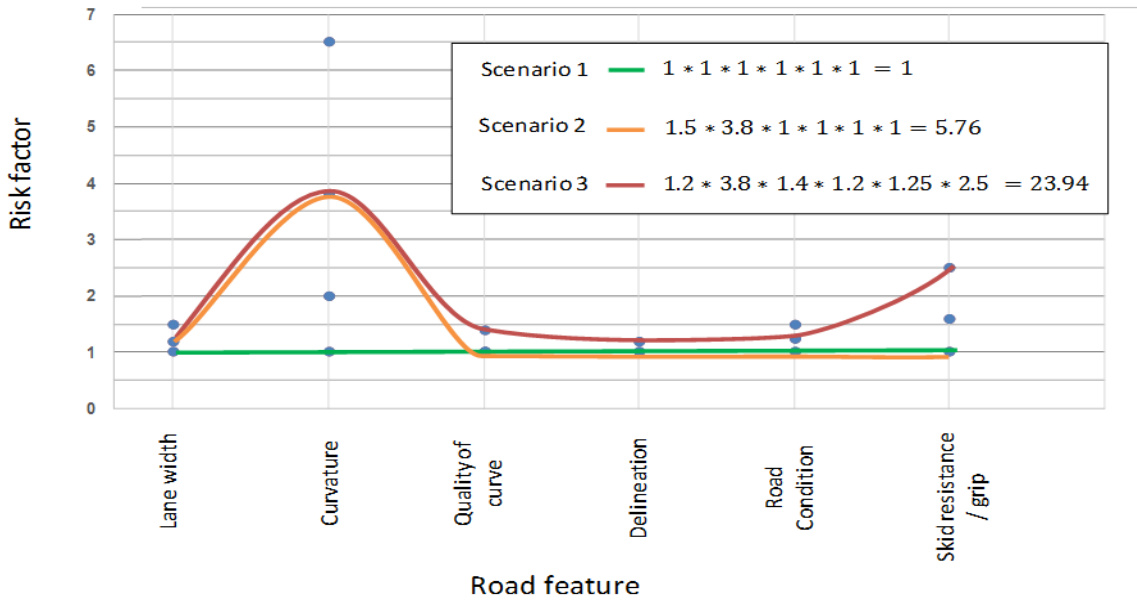
It was identified that: lane width, shoulder width (sealed), curve type and radius, horizontal and vertical sight distances, the condition of the road surface (i.e. deterioration, deformation), objects on the road surface (e.g. service covers, debris), surface texture, drainage of the road surface, signage, delineation and curve quality (i.e. curve warning signs CAMs) all affect the likelihood of a motorcycle crash occurring. The road infrastructure elements affecting motorcycle crash risk, by road engineering discipline are shown in ***Table 1***.

Table 1. Midblock road infrastructure elements affecting the likelihood of a motorcycle crash shown by engineering discipline

Road infrastructure element	Design	Asset management/maintenance	Safety	Examples
Road alignment	✓		✓	Horizontal and vertical curve types, radius, combinations and frequency of changes in the alignment
Sight distance	✓	✓	✓	Horizontal and vertical sight distances due to cuttings and the alignment
Curve quality	✓	✓	✓	Signage and delineation to identify the direction of the alignment and severity of a curve
Overtaking provisions	✓		✓	Frequency of safe overtaking opportunities
Skid resistance / surface texture	✓	✓	✓	Low surface friction pavements and pavement markings, loss of surface friction due to wear and tear (polishing, flushing, crack sealant) and poor drainage (surface water, moss, ice)
Surface hazards	✓	✓	✓	Service pit covers, speed humps, tram/train tracks, raised kerbs, water, poor repair work, edge drop and foreign material
Carriageway width	✓	✓	✓	Lane and shoulder width, particularly on curves, have an effect on riding paths and the distance from a roadside hazard or vehicle in the opposing lane. Shoulder width, condition and if sealed or unsealed
Signage and delineation	✓	✓	✓	Line marking, pavement arrows, guide posts, warning signs and advance direction signs
Surface condition		✓	✓	Delamination, potholes, rutting and corrugations
Road works		✓	✓	Temporary alignment, pavement changes, loose gravel, rough surfaces and steel plates
Roadside hazards	✓		✓	Guardrail, parked cars, utility poles, sign posts and drainage structures

The AusRAP model was applied to a number of different scenarios. The results indicated that the likelihood of a crash occurring increased as various road infrastructure elements were either at minimum standards or more than one element was unfavourable for motorcycles (**Figure 4 and Table 2**).

Scenario 1 is on a straight section of road with wide lanes, adequate delineation good road condition and skid resistance, the crash likelihood score is 1. Scenario 3 is on sharp curve with medium lane width, poor quality of curve and delineation, medium road condition and poor skid resistance, the crash likelihood score is 23.94.



Notes:

- The values for each scenario are the risk factors from Table 2.
- The total value represents the total risk for that combination of attributes.
- The curve plot does not represent the total risk, it shows the fluxion of risk according to the elements in the scenario.

Figure 4. Crash likelihood risk scenarios

Table 2. Examples of crash likelihood factors

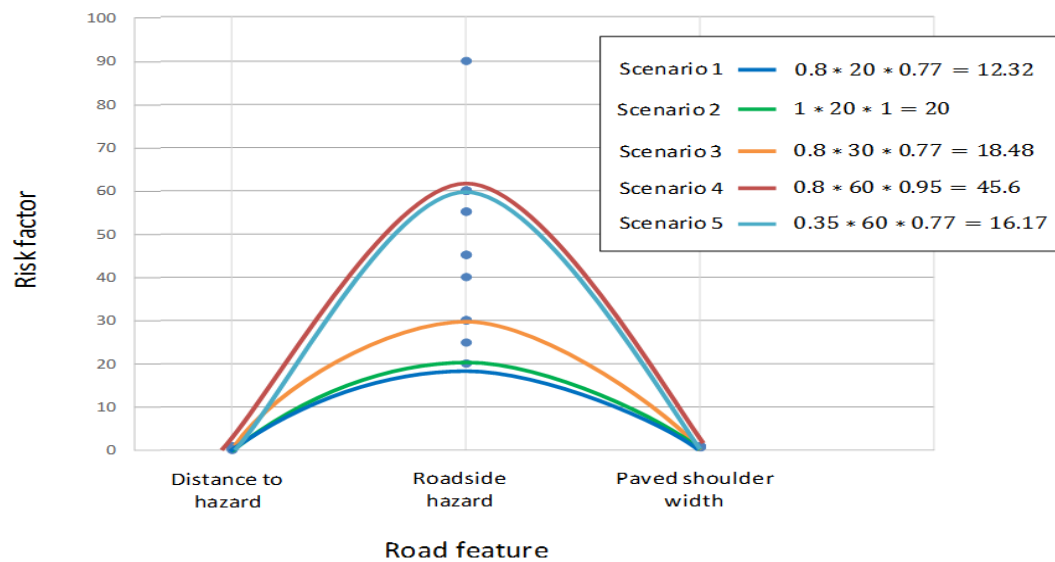
Road infrastructure element	Condition/category	Risk factor
Lane width	Wide (≥ 3.25 m)	1
	Medium (≥ 2.75 m to < 3.25 m)	1.2
	Narrow (≥ 0 m to < 2.75 m)	1.5
Curvature	Straight or gently curving	1
	Moderate curvature	2
	Sharp curve	3.8
	Very sharp	6.5
Quality of curve	Adequate	1
	Poor	1.4
	Not applicable	1
Delineation	Adequate	1
	Poor	1.2
Road condition	Good	1
	Medium	1.25
	Poor	1.5
Skid resistance / grip	Sealed - adequate	1
	Sealed - medium	1.6
	Sealed - poor	2.5

Notes:

- Risk factor values are from the AusRAP model version 3.3.
- Risk factors represent how a road element influences the risk of a motorcycle crash. The likelihood of a motorcycle crash on a straight or gentle curve is 1, however on a very sharp curve it is 6.5 times higher.

The analysis confirmed that almost all roadside objects are hazardous to motorcyclists – and often objects have been designed with passenger vehicles and their occupants in mind, as opposed to motorcycles and their riders.

It was also found that where a roadside object is struck by a motorcyclist, the resulting crash severity is dependent on collision speed, impact angle, the surface area of the object and the impact absorption properties of the object (**Figure 5 and Table 3**).



Notes:

- The values for each scenario are the risk factors from Table 3
- The total value represents the total risk for that combination of attributes
- The curve plot does not represent the total risk, it shows the fluxion of risk according to the elements in the scenario

Figure 5. Crash severity scenarios

Table 3. Examples of crash severity factors

Road infrastructure element	Object, hazard or width	Rural
Distance to object/hazard	0 to <1 m	1
	1 to <5 m	0.8
	5 to <10 m	0.35
	>=10 m	0.1
Object/hazard	Safety barrier - metal motorcycle friendly	20
	Safety barrier - concrete	25
	Frangible structure of building, Safety barrier - wire rope, safety barrier - metal,	30
	Upwards slope - >75 deg	40
	Downwards slope, Upwards slope - 15 to 75 deg	45
	Aggressive vertical face, Deep drainage ditch	55
	Large boulders >= 20 cm high, non-frangible sign/post./pole >=10 cm, non-frangible structure/bridge or building, tree >10 cm, unprotected barrier end.	60
Cliff	90	
Paved shoulder	Paved >= 2.4 m	0.77
	Paved 1 < Width < 2.4 m	0.83
	Paved 0 < Width <= 1 m	0.95
	None	1

Notes:

- Risk factor values are from the AusRAP model version 3.3.
- Risk factors represent how a road element influences the risk of a motorcycle crash. The severity of a motorcycle crash with a motorcycle friendly metal safety barrier is 20, however with a large boulder or non-frangible sign post it is 3 times higher (60).

Recommended mitigation measures

A number of motorcycle safety mitigation measures as outlined in Australian, New Zealand, European and American motorcycle were recommended. Additionally, road design and road safety engineering concepts, in particular the consideration of the resulting risk when a number of elements are aggregated at one location, as demonstrated in the AusRAP model, were also considered when identifying mitigation measures.

The primary recommended mitigation measure to reduce motorcycle crash risk, particularly the likelihood of a crash occurring, is to increase a practitioner's awareness of the road infrastructure element issues that affect motorcycle crash risk. It is considered that this would change practice in all road engineering disciplines, thus contributing towards lowering motorcycle crash risk.

A majority of the mitigation measures, given they are road infrastructure based, can be integrated into existing practice, programming and carried out under existing funding. This applies particularly to asset management and maintenance. A number of mitigation measures can also be applied at the road design stage. However, the effectiveness would vary dependent on the design being a greenfield or brownfield site, however it should be recognised that having sound guidance included in road design guidelines can be referred to by all road engineering disciplines. For this to come into fruition an update of the Austroad Guides for Road Design, Safety, Asset Management, Pavement Technology, Traffic Management, Asset Management and Transport Planning, as per the recommendations from the report would need to be actioned.

Proactive Road Assessment Programs (RAPs) such as the Australian National Risk Assessment Model (ANRAM), AusRAP and iRAP are recommended to be used to identify motorcycle crash risk. A Motorcycle Specific Road Safety Audit, as developed by ARRB Group can be undertaken to identify high risk locations for priority action and motorcycle specific treatment recommendations can be provided. Treatment recommendations consider a hierarchy of control and if the treatment is reducing the likelihood or severity of a crash.

Motorcycle specific warning signage was recommended for use on rural roads to raise awareness of the dangers the road may present to a motorcyclists and also alert passenger vehicle drivers to be aware of motorcycles on the route, with a focus on intersections and on curves (particularly with narrow lane widths).

Proposed mitigation measures for prominent crash types on the midblock

On midblock sections of road it was found that the proportion of crashes involving a motorcycle on curves was higher than the proportion of crashes involving only passenger vehicles on curves, thus targeted mitigation measures for curve crashes have been proposed. The highest represented crash types on curves identified in the crash analysis were head-on crashes and run-off curve crashes. The proposed road infrastructure mitigation measures to reduce crash risk on curves are as follows; improvements to the road surface (in particular re-surfacing) on the curve, curve approach and departure, improving and maintaining delineation and curve quality signage. This is a known practice and is usually implemented in a mass action plan. As these treatments are road infrastructure based, they can over time, be integrated into existing practice and should be the focus of asset management programming and maintenance activities, particularly on roads with considerable motorcycle volumes or a significant motorcycle crash history.

Lane widening and sealed shoulder widening on curves is also recommended, a wide centre line would further reduce the crash risk, however these would require separate funding and programming.

These treatments are applicable on all road types however a focus is on lower order roads, as higher order roads are generally designed and maintained at a higher standard.

Proposed mitigation measures for prominent crash types at intersections

At intersections it was found that the proportion of crashes involving a motorcycle on curves was higher than the proportion of crashes involving only passenger vehicles on curves, thus targeted mitigation measures for curve crashes have been proposed. The highest represented crash types on curves identified in the crash analysis were head-on crashes and run-off curve crashes.

The most effective mitigation measures to reduce crash risk at intersections are as follows: Increasing sightlines at intersections to allow for greater Safe Intersection Sight Distance (SISD) and also allowing a motorcyclist to identify a vehicle on the side road as it approaches the intersection and providing manoeuvring width (**Figure 6**), separating all movements at signalised intersections with designated right turn lanes, protecting turning motorcyclists (signalised and unsignalised) with channelised right and auxiliary left turn lanes will reduce the motorcycle crash risk at intersections.

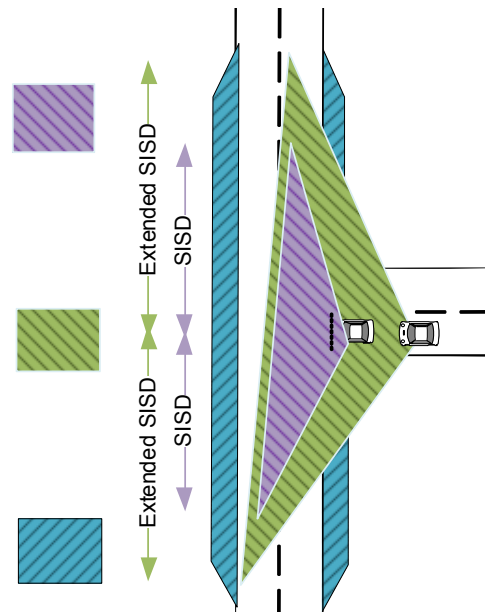
In the likely event that SISD or Approach Sight Distance (ASD) are not able to be provided due to buildings or infrastructure in an urban environment or high cost earthworks in the rural environment, alternative treatments such as 'intersection ahead' pavement markings, special-warning signs or vehicle activated signs could be used (**Figure 7**).

Currently, in some states, motorcycles can legally filter between traffic at intersections (**Figure 8**) to move to the front of the queue. This does reduce the likelihood of a motorcycle being exposed to rear-end crashes however it introduces the likelihood of a side-swipe accident whilst filtering, does not allow a motorcycle to store at the stop line clear of the queue, and as filtering is performed on existing lanes an opportunity for a motorcyclist to filter is dependent on lane width and vehicle placement within the lanes. Providing designated motorcycle lanes at intersections (to guarantee motorcyclists are able to move to the front of the queue to reduce the likelihood of motorcycles being directly or indirectly involved in rear-end crashes and sideswipe crashes whilst turning) is recommended.

Existing practice – The parameters considered in existing guidance for SISD, even when designed to provide the longest distance for a passenger vehicle, do not provide a long enough distance to cater for the non-conspicuous nature of motorcycles and the likelihood of not being identified by a vehicle on the side road or the possible reductions in coefficient of deceleration for motorcycles due to surface condition, surface hazards or rider skill level.

Proposed practice – SISD should be longer than the maximum distances outlined in the design guides, and allow a rider to see a vehicle approaching on the side road. The additional sight distance and view to an approaching vehicle will allow a rider to identify an approaching vehicle and reduce speed in anticipation of not being identified and being able to stop before the conflict point. It will also provide additional stopping distance to allow for varying road conditions, hazards and rider skill and braking abilities.

Proposed practice – Provide manoeuvring widths to avoid a collision. Provide a wide shoulder (T-intersection) and widen lane/s.



Note: This diagram is also applicable to cross intersections

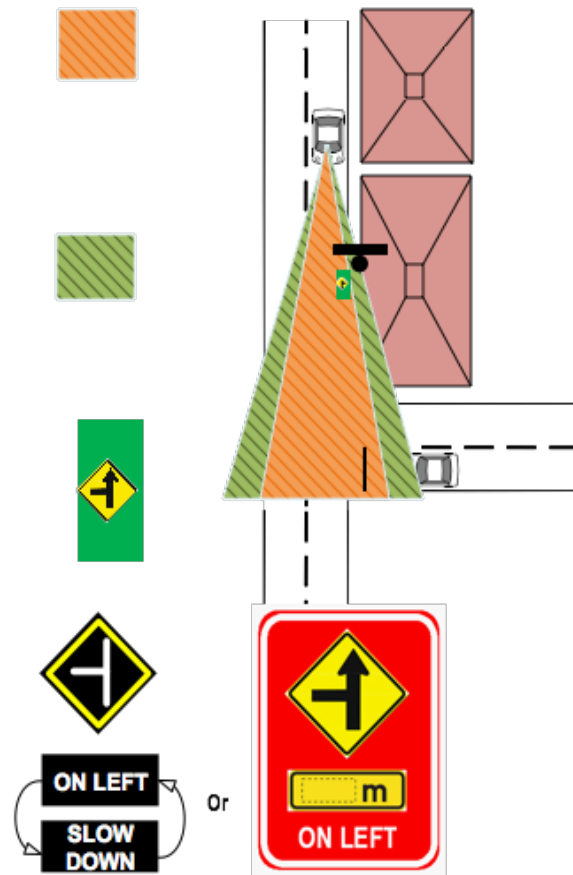
Figure 6. Safe intersection sight distance to approaching vehicles and manoeuvring width

Existing practice – SISD sight lines from the hold line . SISD does not factor in the non-conspicuous nature of motorcycles and the likelihood of not being identified by a vehicle on the side road or the possible reductions in co-efficient of deceleration for motorcycles due to surface condition , surface hazards or rider skill level .

Proposed practice – SISD sight lines from side road approach . Additional sight distance will allow a rider to identify an approaching vehicle and reduce speed in anticipation of not being identified and being able to stop before the conflict point . It will also provide additional stopping distance to allow for varying road conditions , hazards and rider skill and braking abilities .

Proposed treatment – Use pavement marking to clearly identify a side road on the left in urban areas with cluttered signage or rural areas with restricted sightlines . Pavement marking should only be used if a high surface friction paint is used and maintained . The pavement marking should only take up 1/3 of the lane width and be close to the shoulder . This would require performance trials prior to being used .

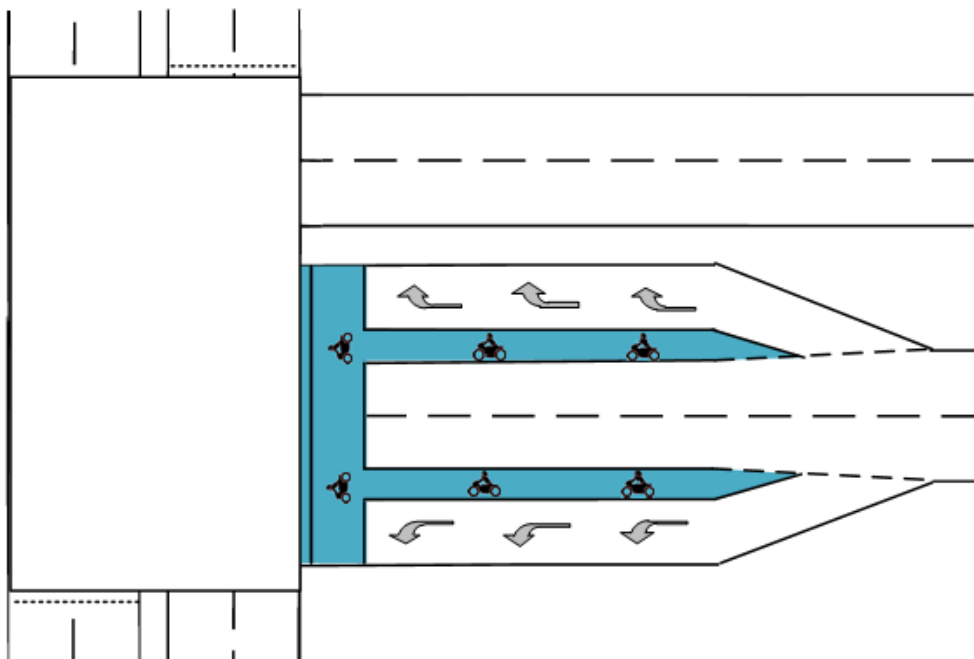
Proposed treatment – Use vehicle activated signs or special warning signs to clearly identify a side road on the left in urban areas or rural areas with restricted sightlines .



Notes:

- A combination of pavement marking and signage may be applicable in some situations.
- Diagram also applicable to cross-intersections.

Figure 7. Safe intersection sight distance - alternative treatments



Note: Diagram also applicable to all legs and at a cross-intersection.

Figure 8. Designated motorcycle lanes at major signalised intersections

Safety Benefit Analysis

A safety benefit analysis was undertaken using the motorcycle model in AusRAP. The analysis took into consideration the following improvements on the midblock: delineation, curve quality, skid resistance, road condition, lane widening, sealed shoulder widening and sight distance. At intersections it took into consideration the inclusion of right turn lanes, channelisation and improvements to intersection design, advance warning, signing and markings (intersection quality).

An assessment was undertaken on an existing alignment (Magill – Lobethal Road, SA) with a pre-existing motorcycle crash history. The road is a mountainous rural connector road, approximately 35 km, with a posted speed limits of 60 km/h or less for 36% of the road and the remainder at 80 km/h, an AADT of 3100 and motorcycle flow of 110 and a crash history with an average of 2.4 motorcyclist fatal or serious injury (FSI) crashes a year over a five year period.

The analysis showed that by treating the road infrastructure elements that affected crash likelihood, 18 FSI crashes could be prevented over 20 years with BCRs (calculated using Qld willingness to pay figures) for each treatment ranging between 2 and 12. The treatments included improvements to skid resistance and road condition, delineation and curve delineation/curve quality, sight distance, sealed shoulder widening and lane widening.

The analysis showed that by treating the road infrastructure elements that affected crash severity, 12 FSI crashes could be prevented over 20 years with a BCR of 3. The treatments included providing motorcycle safety barriers and clearing roadside hazards. It should be recognised that the likelihood of clearing some roadside hazards such as trees is low.

Stakeholder Consultation

The findings of the study were shared for feedback via a survey and then discussed in a workshop. Representatives from the Australian Motorcycle Council, state motorcycle advocacy groups, International Roads Assessment Program (iRAP), representatives from Australian road agencies and in New Zealand in the road design, road safety, finance, road operations, network programs, asset management and maintenance road engineering disciplines participated in the survey and attended the workshop.

The survey results and workshop discussion concluded that the findings of the report were reflective of the current issues relevant to motorcyclists and road agencies. It was unanimously concluded that identifying motorcycles as a road user group and providing technical guidance for them in a number of Austroads Guides required to raise awareness of the issues presented to motorcyclists as a result of road infrastructure and manage motorcycle crash risk. It was also recognised that motorcycle crash risk can be managed through existing asset management programming, maintenance and road design practices.

Conclusion

The following key messages (which will be further detailed within the forthcoming Austroads technical report) should be recognised and considered by practitioners in safety, design, asset management, maintenance, pavement technology road engineering disciplines, in order to determine how their existing knowledge can be combined with the proposed mitigation measures to reduce motorcycle crash risk:

Motorcyclists are recognised as a unique road user group and have specific needs with regards to road infrastructure.

The likelihood of a crash occurring and its likely severity are both important considerations, however with more focus on treating road infrastructure elements that affect likelihood further crash reductions can be achieved.

It is perhaps more economical to treat road infrastructure elements that effect the likelihood of a crash occurring. Greater reductions in fatal or serious injury crashes (FSIs) may be achieved through a targeted focus on reducing the likelihood of a crash occurring as well as reducing the severity of a crash.

As the proposed mitigation measures are road infrastructure based treatments, it is seen that over time they can be integrated into existing practice and therefore existing funding.

Motorcycle crash risk should be proactively identified and a remedial action program developed through motorcycle focused network safety assessments or road safety audits.

It is recommended that motorcycle crash risk should be assessed on all state and national roads to identify the motorcycle safety risk and provide an indicative remedial action plan outlining mitigation measures.

The proposed treatments should be the focus of asset management programming and maintenance activities, particularly on roads with considerable motorcycle volumes or a significant motorcycle crash history. The key messages and proposed mitigation measures (once proven effective) should be integrated in the Austroads Guides for each relevant road engineering discipline so road infrastructure as a crash factor can be proactively reduced through good practice as well as reduced by remedial actions.

A number of infrastructure mitigation treatment trials have been implemented in Australia and New Zealand using existing motorcycle safety guidance. The proposed mitigation measures outlined, particularly those addressing trending crash types, should be investigated further and considered to be trialled. These mitigation measures should also be trialled through existing programs and funding such as asset management and maintenance.

The results of such trials may provide the evidence required to influence a change in industry practice, where practitioners in all road engineering disciplines, inherently cater for the needs of motorcyclists, thus reducing the risk of road infrastructure being a factor in motorcycle crashes.

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