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our communities

# Making Roads Motorcycle Friendly

A guide for road design construction and maintenance

February 2022



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## // Foreword from Victorian Minister for Roads and Road Safety

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Motorcyclists and scooter riders are an important part of our transport mix in Victoria, however they are overrepresented in our road trauma. The reasons for this overrepresentation are not a single cause, but many contributing factors such as the speeds at which we travel; the safety features of the vehicles on our roads; and the design, operation and maintenance of our roads and roadsides.

The Victorian Government is committed to improving road safety for all Victorian road users and this will involve altering the way we manage our road system to protect all road users.

The Making Roads Motorcycle Friendly package (manual, videos and training course) guides individuals working for government organisations and industry who are involved in road planning, design, construction, operation, and maintenance. It provides broad guidance on elements of the road environment that contribute to motorcyclist and scooter rider crashes, and resultant trauma, and presents practical ways to reduce these risks.

Victoria was the first jurisdiction to develop a Making Roads Motorcycle Friendly package, which was originally released in 2014. We shared our work with other jurisdictions to assist them in addressing their motorcycle and scooter safety issues and are delighted to see replica packages in Western Australia, New South Wales and New Zealand. This package has also been used in various forms in 12 other countries around the world.

In 2017, Making Roads Motorcycle Friendly received a Prince Michael International Road Safety Award in acknowledgement of the contribution this package and the associated training course has made to motorcycle safety both within Australia and internationally.

We have updated the document to ensure that the Making Roads Motorcycle Friendly package is providing best-practice information based on the latest research and we are committed to the continual update of the package as new research and technology emerges.

**The Hon Ben Carroll**  
Minister for Roads and Road Safety



# Introduction

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Motorcycling is a popular choice of transport for many people. For commuters, it is a cost and fuel-efficient form of private transport.

**It offers the convenience of ease of parking in congested areas and reduces traffic congestion.**

**For these same reasons, it is also a popular choice of transport for those who work as couriers and food deliverers. For others, it is a desirable recreational activity for short rides lasting a few hours, full-day trips or multiple day trips.**

## Crash Data

In Victoria from 2015 to 2019, inclusive, there were a total of 205 motorcyclists who lost their lives<sup>1</sup>. This roughly equates to just under 41 motorcyclists' lives lost per year and represents approximately 16% of all lives lost on Victorian roads each year even though motorcycles constitute less than 4% of all registered vehicles. A further 786 motorcyclists are seriously injured each year and this represents approximately 17% of all serious injuries sustained on Victoria's roads. These figures highlight the vulnerability of motorcyclists<sup>2</sup>, that they are over-represented in road trauma and that more actions need to be taken to protect them.

Of the fatal and serious injury motorcycle crashes that have occurred in the last 5 years:

- 63% metro areas
- 37% rural areas
- 48% single vehicle crashes
- 52% multiple vehicle crashes.

Single-vehicle crashes:

- 35% involved impacting roadside furniture

Of the multiple-vehicle crashes:

- 81% occurred in metro
- 19% occurred in rural areas
- 54% occurred at intersections.

A combination of factors is involved in most crashes. These include the behaviour of other vehicle drivers, the motorcycle rider themselves, excessive speed, fatigue, alcohol and drugs. However, the engineering of the road surface and road side environment can have a significant influence on reducing the likelihood of a crash and, if a crash is not avoidable, the injury severity sustained by a motorcyclist.

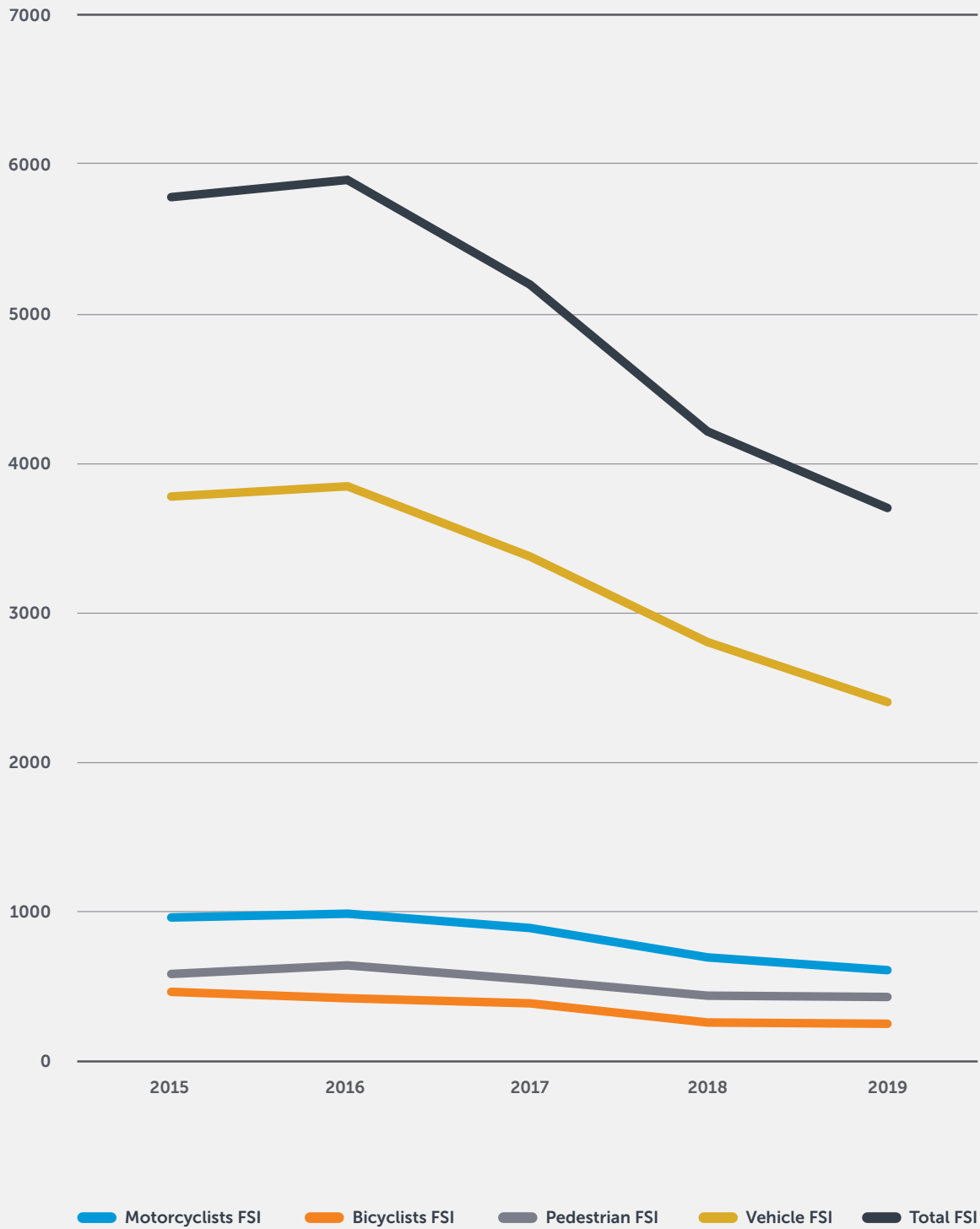
To achieve significant reductions in motorcyclist fatalities and serious injuries will require all elements of the Safe System working together. There will be a need for safer riding, safer motorcycles, safer speeds and safer road maintenance prioritisation and roadsides.

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<sup>1</sup> Data obtained from Road Crash Information System and Victorian Government Open Data – includes pillion riders.

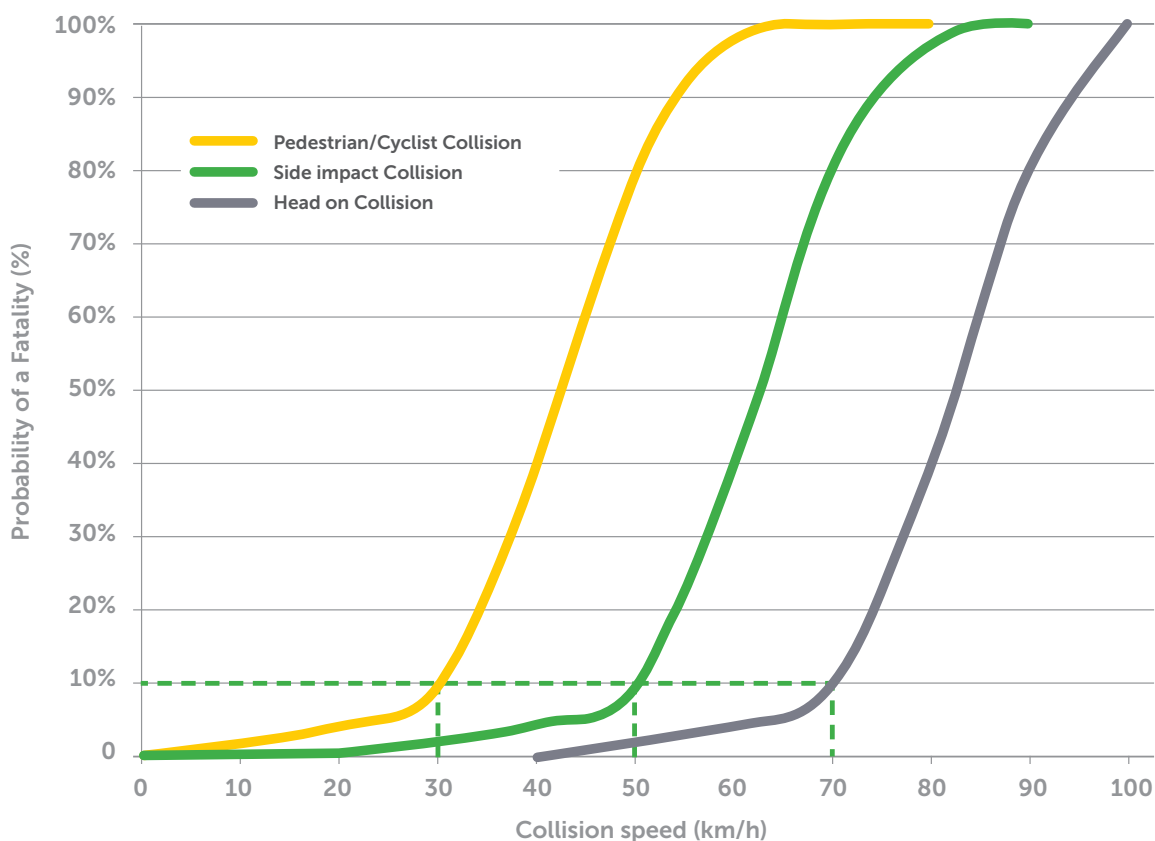
<sup>2</sup> The term "motorcyclist" in this document refers to both motorcyclist and scooter riders

## Total Number of Fatal and Serious Injury (FSI) Crashes (2015-2019)



Number of motorcycle fatal and serious injuries recorded over the last five years (2014-2019). While the crash trend is going down, a sustained investment is required to achieve improved safety outcomes for riders.

## Relationships between collision speed and probability of a fatality for different crash configurations



Source: Jurewicz, Sobhani et al. (2015) and based on Wrangborg (2005)

“ The tolerable level of impact for a motorcyclist is considered similar to that for pedestrians.

### The Safe System

Victoria has adopted the Safe System approach to road safety. A Safe System is one that places human health at the centre of the road system, recognises people are vulnerable, shares road safety responsibility, recognises that people make mistakes and that these mistakes should not result in fatal or serious injuries.

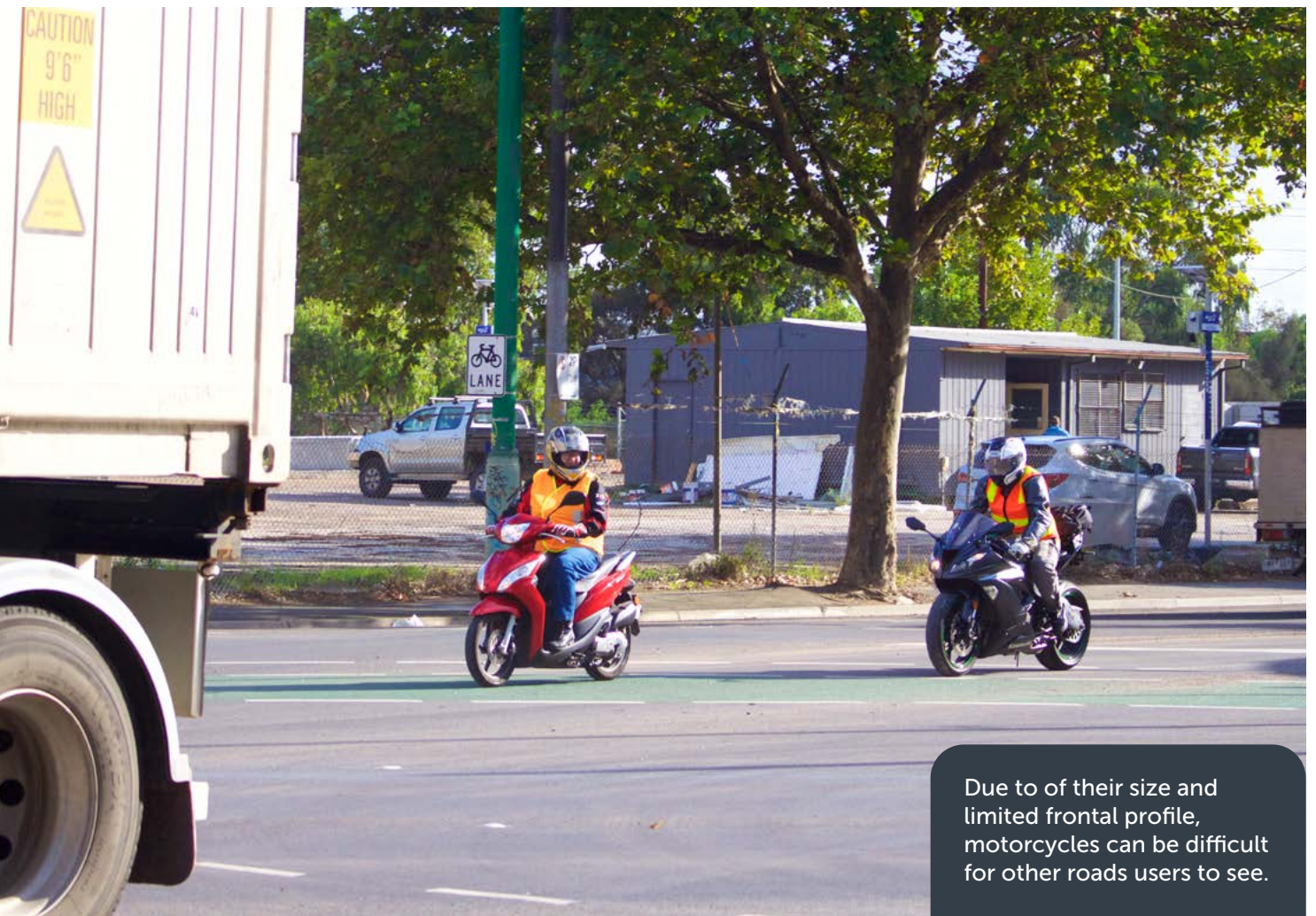
Motorcyclists, along with pedestrians and bicycle riders, are the most vulnerable road users in a crash. They have limited, if any, crash protection and rely on good road and roadside design to minimise the risk of a crash occurring.

Roads should be designed in a way that they are self-explaining and forgiving if a crash were to occur. Road works should be carried out

in the safest possible way and the roadway must be left correctly reinstated when works are completed. Road authorities are responsible for maintaining the roads and issuing repairs when necessary.

Safe speeds should be assigned to roads to ensure that if a crash is to occur, the impact speed will fall within the tolerable range for that particular crash. Pedestrian, side-impact and head-on crashes for vehicles have tolerable impact speeds of 30, 50 and 70 km/h, respectively, and noting that the tolerable level is defined by a 10% chance of fatality at impact speed. The tolerable speed for motorcyclists is considered similar to that for pedestrians. The reliance on safe roads and safe speeds to keep these road user groups safe provides a challenge for those involved in designing, constructing and maintaining Victoria's road network.





Due to of their size and limited frontal profile, motorcycles can be difficult for other roads users to see.

### The Role of Road Authorities

Road authorities can contribute to the safety of motorcyclists through the establishment and maintenance of reasonable standards for road design and construction. Performing regular road inspections, maintenance and repairs which consider factors, such as those listed in this manual, that particularly affect motorcyclists will also assist in making the roads safer for motorcyclists. Contractors also have an obligation to ensure that road works are performed to a level that ensures the safety of all road users and that the road surface is correctly reinstated in accordance with the standards.

The Road Management Plan should also be used in addition to this manual when performing regular road inspections, maintenance and repairs but keeping in mind that the guidelines were developed for road users as a whole.

Motorcycles have a lower hazard tolerance threshold and are more sensitive to poor road surface conditions so an enhanced maintenance program may be needed for popular motorcycling routes and roads.

The prioritisation of certain types of road maintenance works above others due to resource constraints can be challenging as all road users' needs need to be considered. However, a well-developed maintenance program will seek to balance road safety, tourism, freight demands, environmental values, fire risks and the needs of vulnerable road users such as pedestrians, cyclists and motorcyclists.

This Making Roads Motorcycle Friendly guide has been written with road designers and maintenance crew in mind and, as such, the issues and suggested solutions focus on the Safe Roads (and Roadsides)

and Safe Speed pillars of the Safe System. Further, this guide has been developed to assist with the identification of road and roadside hazards that affect motorcyclists and provide suggestions on potential solutions.

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### Road Risk Factors for Motorcyclists

The design of motorcycles and scooters means that they have dynamic stability characteristics that are unique compared to other vehicles on our roads. This uniqueness means that they interact with the road somewhat differently to other road users and have specific safety needs.

### Roads

Motorcycles are very sensitive to changes in the shape, texture and skid resistance of the road surface. They are much lighter than other vehicles which results in them having less surface traction. This surface traction is usually reduced when water or debris is present on the road. Motorcycles lean into curves resulting

in the tyre needing to provide traction to move forward as well as to keep the motorcycle upright. Unlike other vehicles, motorcycles only have two points of contact with the road - the front and rear tyres. The loss of traction by either the of these tyres can result in a crash. For these reasons, motorcycles are very reliant on good and consistent traction.

A motorcycle's suspension is generally stiffer than that of other vehicles. This stiffer suspension means that they are more sensitive to surface irregularities. Surface irregularities can result in a loss of traction and also throw a rider off balance. As such, motorcycles are also reliant on good and consistent road surface quality.

Motorcycle friendly treatments should be considered for popular motorcycling routes. These routes include many inner city and suburban roads where motorcycles and scooters are used by commuters, courier and food delivery services. Popular motorcycling routes are also found in rural areas and can sometimes include roads where total traffic volumes may be relatively low. These routes usually consist of narrow winding mountain roads and are often visited on weekends. Examples of such routes are the Great Ocean Road, the Great Alpine Road and Mount Dandenong Tourist Road. The road and roadside treatments outlined in this guide should be considered for popular motorcycling routes in the inner city and rural areas.





Through the Motorcycle Graduated Licensing System (MGLS) and support from experienced riders, new riders will be equipped with stronger skills.

### Visibility

Motorcycles are smaller than other vehicles and are easily hidden by roadside furniture and vegetation making them inconspicuous. This is particularly true when a motorcycle is viewed front-on. Motorcyclists may move around frequently in the traffic lane they are travelling in and do not always follow car, truck or bus wheel paths. This manoeuvrability and small size can make them harder to spot by other road users - particularly when riders are lane filtering.

Two common causation factors in motorcycle crashes are “looked but failed to see” and “other vehicle turns into path of the motorcycle”. Road design can assist in reducing these types of crash causation by removing or reducing visual obstructions such as signs and vegetation to improve sightlines for both motorcyclists and other road users.

### Motorcycle Personal Protective Equipment

Motorcyclists are generally encouraged to wear motorcycle-specific Personal Protective Equipment (PPE) beyond that of a motorcycle helmet which is mandatory. These include gloves, jackets, pants and footwear.

Although motorcycle PPE has been shown to reduce injury severity in the event of a crash, they best protect a motorcyclist against abrasion rather than impact forces. Motorcyclists are just as vulnerable as pedestrians and cyclists from impact injuries and this is particularly true when they impact another vehicle or road side objects.

The [MotoCAP](#) website enables riders to make informed decisions regarding the effectiveness of motorcycle protective clothing.

**“ Two common causation factors in motorcycle crashes are “looked but failed to see” and “other vehicle turns into path of the motorcycle” .**

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**A**

Tyres provide only two small points of contact with the road surface. The loss of traction of either tyre can result in a crash.

**A**

**B**

Motorcyclists rely on consistent tyre grip.

**C**

The majority of braking force is through the front tyre.

**D**

Motorcyclists lean into corners and bends and rely on tyre grip keep the motorcycle upright. Their small size and small frontal profile results in motorcycles being inconspicuous.



# 1. Road Design

## 1.1. Tram and Train Tracks

Tram and train tracks can be hazardous for motorcycles as they are a slippery surface which can result in a loss of traction. This is exacerbated when the tracks are wet. Specific areas where tram tracks can be a hazard for motorcyclists include tram track intersections, tram tracks merging, uncontrolled access areas, tracks located in curves, where there is a change in pavement surface and where tracks join the pavements. Motorcycle hazards associated with latter include water pooling due to drainage issues, broken surfaces, rubble, build up of line markings, debris and sand. These issues, if traversed, can contribute to a loss of control for motorcyclists.

### Treatment Options

- Ensure that the road surface and pavement around tram tracks is not broken and well maintained.
- The road surface alongside and between the tracks should be level with the tracks. Avoid rises and dips as they may cause a loss of stability.
- Install warning signs where multiple tracks crossing are present or tracks are located on curves.

### ! Note

Liaison between tram/rail authority, local government and The Department of Transport is critical for the coordination of repairs and maintenance around tram/rail tracks.

### Example of Issue



Surface cracking and breaking near tram tracks can cause motorcycle instability if they are traversed.



Tram track intersections can be a particular hazard for motorcyclists due to the loss of traction at multiple points if the tracks are traversed.



Explanatory video: [Tram Tracks](#)

## 1.2. Pit Lids

The top surface of metal utility covers and access manholes can be slippery, particularly when wet. The issue is often compounded by the cover sitting either above or below the road surface. The presence of different surface types adjacent to each other can result in a motorcycle or scooter losing braking control. A difference in surface levels can result in water and debris pooling around the utility cover which, in turn, can result in a loss of traction for a motorcycle or scooter.

### Treatment Options

- Use skid resistant material/coating for on-road lids. Ideally the material/coating colour should contrast with that of the surrounding road surface.
- Ensure pit lids are mounted flush with the road surface.
- Monitor pit lids frequently and repair or replace when required.
- For new installations, locate lids away from traffic lanes.

### ! Note

When re-surfacing the road, ensure scheduling of raising the pit lids occurs at the same time. Where this is not possible, other risk mitigation measures must be in place to warn riders of the surface level difference.

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The presence of different surface types adjacent to each other can result in a motorcycle or scooter losing braking control.

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### Example of Issue

Photo Source: Safe System Solutions Pty Ltd



Uneven surfaces and surface breaks near utility covers can make it harder for motorcyclists to brake safely.



Metal utility covers can be slippery for motorcyclists, especially when wet.



Explanatory video: [Pit Lids](#)



### 1.3. Unsealed Shoulder / No Shoulder

Road shoulders provide a safe recovery area for any vehicle that leaves the running lane. If road edges are broken or contain loose gravel this can create a serious hazard and make recovery more difficult, especially for motorcycles.

#### Treatment Options

- Consider shoulder sealing on popular motorcycle routes, especially on curves.
- Consider sweeping or performing suction cleaning to remove accumulated material around traffic islands and other areas of the road.

#### ! Note

Any aggregate in unsealed shoulders should contrast that of the sealed pavement to clearly delineate the sealed surface to that of the unsealed shoulder to riders.

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Road shoulders provide a safe recovery area for any vehicle that runs off the running lane. If road edges are broken or contain loose gravel this can create a serious hazard and make recovery more difficult, especially for motorcycles.

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#### Example of Issue

Photo Source: Safe System Solutions Pty Ltd



Unsealed shoulder with edge breaks makes recovery more difficult for motorcyclists.



Accumulated gravel, especially when its colour is similar to that of the road surface making it indistinguishable to that of the road, is a hazard for motorcyclists.



Sealed road shoulders provide a safe recovery area for all vehicles.

## 1.4. Kerbs

Kerbing is used to transition from a road to another surface such as a footpath, a nature strip with footpath, median or outer separator. The change in height is a hazard to motorcyclists and may destabilise a rider.

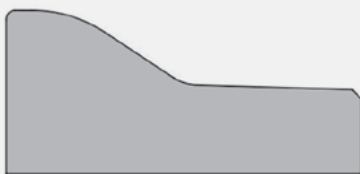
### Treatment Options

- Where possible, install mountable kerb where motorcycles are likely to be riding near a kerb (e.g. islands, on the inside of curves, and narrow lanes) and also on popular motorcycle routes. Where it is not possible to install mountable kerb, consider installing semi-mountable kerb and/or highlighting the kerb using different coloured material to that of the road surface or paint with high skid resistant paint. Kerbs can also be installed at cuttings to improve drainage and reduce potential water hazards on the road.

### ! Note

The lip of any mountable aprons should contrast the surrounding pavement.

### Examples of recommended kerb type



Semi Mountable Kerb



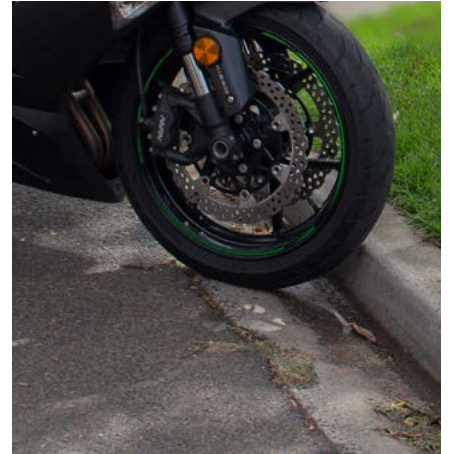
Mountable Kerb

### Example of Issue



Kerbs can be a hazard if a motorcycle inadvertently travels over them especially on curves along popular motorcycling routes.

Photo Source: Safe System Solutions Pty Ltd



Kerbs can be a hazard if a motorcycle inadvertently travels over them due to the height of the kerb in comparison to the wheel size.

### Example of treatment



Install mountable kerbs where motorcyclists are likely to be riding near a kerb and along popular motorcycling routes.



Explanatory video: [Kerb Types](#)



## 1.5. Change in Surface Type

A change in surface type can result in a change in tyre grip available to the motorcycle. This may result in a motorcycle losing traction in curves or a loss of braking force in straights.

### Treatment Options

- Avoid placing different materials adjacent to each other longitudinally in the running lane, especially in areas where braking is likely to occur or in corners.
- Any surface changes should occur where motorcyclists can traverse the join perpendicularly while they are upright and not braking.
- Any major surface change (e.g. from sealed to unsealed) should be clearly defined and signed.

### Example of Issue

Photo Source: Safe System Solutions Pty Ltd



A simultaneous change in surface type and surface height can result in a motorcycle losing traction.



A change in surface type can result in a motorcycle losing traction, especially when one of the surfaces is loose gravel.



A change in surface type on curves or in a corner can result in the motorcycle losing traction, especially if the surface is wet.



## 1.6. Visibility

Visibility is particularly important for motorcyclists. Unlike other larger vehicles on the road, motorcycles have a small profile which makes them difficult to see, especially if obscured by roadside features such as plantings, fencing, barriers, signage or parked vehicles.

Also, motorcyclists need to clearly see the road ahead to avoid any hazards such as surface defects or other vehicles.

### Treatment Options:

- Trim vegetation where visibility is impaired especially at curves and intersections.
- When selecting vegetation for planting, ensure a mature growth height that does not interfere with sight lines or select low ground cover vegetation.
- Install longer KEEP CLEAR zones, especially at uncontrolled intersections to provide greater visibility for motorcycles in stop/start traffic.
- Ensure a clear view for road users at critical locations such as roundabouts, intersections or on bends.
- When undertaking sight distance reviews, consider sight distance impediments that would restrict visibility to a motorcyclist, not just a larger vehicle.

### Example of issue

Photo Source: Safe System Solutions Pty Ltd



Trees and roadside furniture can easily obscure motorcyclists.



Motorcyclists are easily obscured by other vehicles and roadside furniture due to their small size.



Explanatory video: [Visibility](#)



## 1.7. Advisory Speed Signage

Advisory speed signage is installed where road geometry is substandard for the posted speed limit or design speed. Correct advisory signage enables a rider to make better decisions about the correct speed for substandard road sections. Where there is no advisory speed signs and it is required or where there is inconsistency in advisory speed signage along a route, riders are at a greater risk of losing control of their motorcycle.

### Treatment Options

- Ensuring routes meet the requirements of AS1742.2 (Manual of Uniform Traffic Control Device for General Use) & AS1742.4 (Manual of Uniform Traffic Control Device for Speed Control) can significantly reduce the likelihood of motorcyclist crashes.

### ! Note

The addition of signs can create a strike hazard for motorcyclists. Where possible remove redundant signage, consolidate sign elements and/or consider installing flexible motorcycle friendly sign support poles (e.g. plastic break-away, rubber self-righting or flexible posts).

### Example of treatment

Photo Source: Safe System Solutions Pty Ltd



Advisory signage can assist motorcyclists with their decision making along popular motorcycling routes.



Advisory signage can assist motorcyclists with their decision making, especially when sightlines are obstructed.



Explanatory video: [Advisory Speed Signage](#)

## 1.8. Warning Signs

Motorcyclists are generally highly aware of warning signs. Warning signs provide information about a change in the road environment (e.g. intersections, tight curves, crests, wildlife, etc.). If warning signs are inconsistent or missing riders may be surprised by hazards which increases the risk of a crash occurring.

### Treatment Options:

- Undertake motorcycle focused road safety audits to check for missing or misleading signage and for sign consistency along a route.
- Special motorcycle high risk warnings signs are recommended for hazards that are a particular issue for motorcyclists.
- Investigate motorcycle friendly sign support poles (e.g. plastic break-away, rubber self-righting or flexible posts\*).
- Use motorcycle route-based signage for high risk routes

\* Note: The term "frangible" usually denotes break-away upon impact from a car/truck. Most "frangible" posts/poles are not frangible for motorcyclists.

### ! Note

Excessive road signage can distract or confuse a motorcyclist and is a potential strike hazard for an errant rider. Removal of superfluous signs and consolidation of signs reduces risk for motorcyclists.



An example of signs mounted on plastic flexible posts.

### Example of warning signs



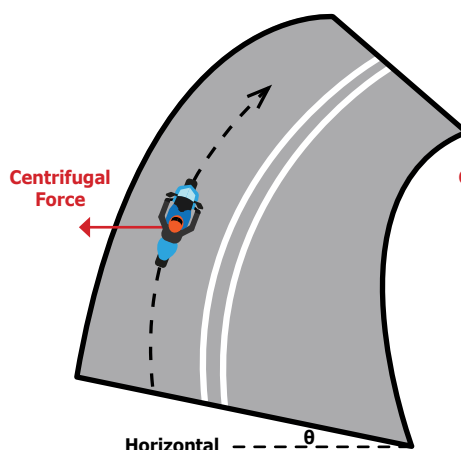
## 1.9. Adverse Superelevation

Superelevation of a curve provides a raised surface to counter the centrifugal force of the vehicle navigating the curve. Adverse superelevation is when the road is angled in such a way that the surface does not counter the centrifugal force experienced by a vehicle navigating a curve. Adverse superelevation results in a greater reliance on a motorcycle's tyres grip to negotiate a curve. Further, it reduces the amount of 'lean' a motorcyclist can use to negotiate a curve. The combination of both of these issues can result in a motorcycle losing its stability and grip in a curve.

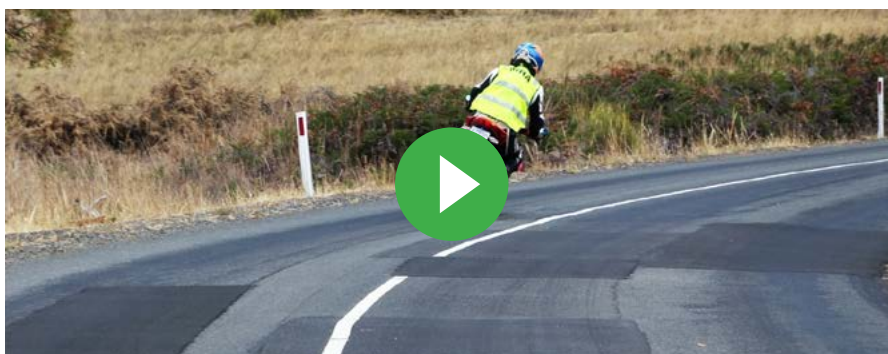
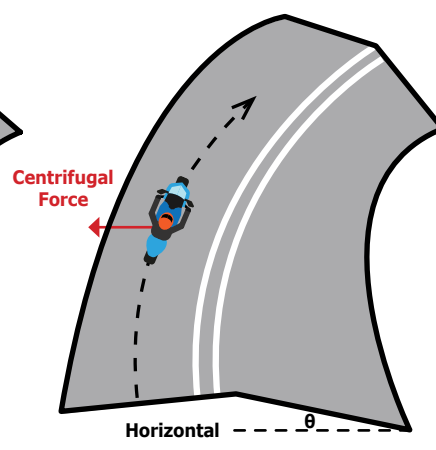
### Treatment Options:

- Ensure superelevation meets design standards.
- Do not use adverse superelevation where motorcycle operating speed is likely to be high (this may include consideration of roundabout design for higher speed roundabouts).

### Superelevation



### Adverse Superelevation



Explanatory video: [Road Cross-fall](#)



## 1.10. Delineation and Lighting

In addition to the appropriate use of signs, other delineation devices such as line marking and guide posts help all road users, especially motorcyclists, in 'reading' the road ahead. Inconsistency in line marking or guide posts can make it difficult for motorcyclists to anticipate and react to changing road geometry and conditions.

Good delineation provides the rider with information about the road environment. The inherent instability of a motorcycle means that information about the road can be critical in judging speed and direction. Adequate lighting can highlight conflict areas for motorcyclists (such as intersections) and highlight road features that could be a hazard to a rider (such as kerbing). Adequate lighting can also illuminate the presence of a motorcyclist to other road users, especially in traffic conflict areas such as intersections.

### Treatment Options:

- Ensure consistency of line marking, especially along popular motorcycle routes. In non-urban areas these routes are generally roads with curves and are often used on weekends for recreation.
- Ongoing maintenance of line marking is required to maintain its visibility and retroreflectivity
- Consider lighting improvements at intersections or conflict points.
- Undertake motorcycle focused road safety audits to check for delineation clarity and consistency as well as adequate lighting.
- On popular tourist routes with undivided roads, consider applying skid-resistant lane direction arrows to reduce vehicle encroachment across the centreline at blind corners.

### Example of poor lighting

Photo Source: Safe System Solutions Pty Ltd



Poor lighting can result in motorcyclists being hard to see.



The lack of edgelines makes it difficult for motorcyclists to "read" and plan for the road ahead.

### Example of good delineation



Delineators assist motorcyclists by indicating the direction of the road ahead, especially at night.



Explanatory video: [Delineation](#)

### 1.11. Curve Tightens (Compound Curves)

Compound curves present a particular challenge for motorcyclists. Motorcyclists will set up their motorcycle for a curve prior to the start of a curve. This will involve selecting a travel line which, in turn, involves selecting a speed and lean angle. The dynamics of a motorcycle makes it difficult to change the travel line mid-curve.

Compound curves require a motorcyclist to change their travel line mid-curve often with very little notice and can result in a crash.

#### Treatment Options:

- Ideally compound curves would be realigned to lessen the risk for riders; however, it is acknowledged that this is a high cost treatment.
- Where realignment is not possible, a compound curve where the approach speeds may be high should be signed with a compound curve warning sign (AS1742.2)
- Opening sightlines around the curve can aid a rider to anticipate the tighter second curve.



### 1.12. Intersections

Due to their smaller size motorcycles are particularly vulnerable of either not being seen or having their distance and speed being misjudged by other road users.

To increase the likelihood of a motorcyclist being seen by drivers of other road users, sight lines should be kept clear and, where possible, controls installed (e.g. fully controlled right turns).

Lowering speeds at intersections provides drivers with more time to identify riders and react. Also, it provides more time for a motorcyclist to react to a vehicle that has entered their travel path.

#### Treatment Options:

- Where intersections are passively controlled (e.g. where GIVE WAY or STOP signs are located):
  - Ensure that sight lines are clear of obstructions that could obscure motorcycles.
  - Reduce the speed of the priority road vehicles through the conflict points. This may include the introduction of a roundabout, vehicle activated warning signs, speed limit reduction (permanent or vehicle activated) or, in some cases, a raised safety platform.
- Controlling the intersection with traffic signals
- Eliminate median breaks by closing them.

#### For traffic signals:

- Adopt fully controlled right turns when traffic turns over more than one lane and/or speeds are above 50km/h
  - Apply high friction surfacing on the approach to and through the intersection where a rider may need to perform emergency braking or manoeuvres.
- Note:**
- For commuter routes, consider installing lighting at intersections and roundabouts.
  - The design of a roundabout on a popular motorcycle route should consider motorcycle friendly sign support poles (e.g. plastic break-away, rubber self-righting or flexible posts) on the approach to and within the roundabout.
  - Where motorcyclists are permitted to travel in the bus lane, they are more susceptible to dynamic visual obstruction (i.e., masking) issues at intersections and may not be anticipated by vehicles turning into and out of a side road.

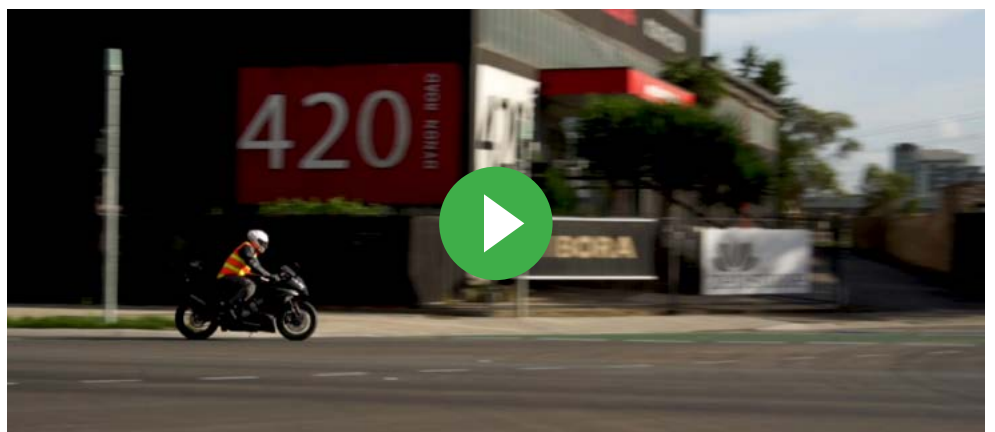
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To increase the likelihood of a motorcyclist being seen by drivers of other road users, sight lines should be kept clear and, where possible, controls installed (e.g. fully controlled right turns).

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Example of Issues



Explanatory video: [Intersection Issues](#)



## 2. Roadside Design

### 2.1. Fixed hazard (tree/fence/pole)

Fixed hazards are a hazard for motorcyclists either in the path of an errant motorcycle or if the rider is separated from their motorcycle in a crash and subsequently impacts the fixed object. Safety barriers are installed to shield road users from hazards that may cause injury. Safety barriers can have significant benefits for motorcyclists by, for example, preventing them from impacting trees and posts, falling down a batter or impacting a rock wall.

#### Treatment Options:

- Relocate or remove the hazard, especially those that are close to the roadway.
- Install flexible w-beam guardrail with motorcycle under run protection.
- Install appropriate pole and post padding (such as Bikermate or ImpactProtect or other approved products) for utility poles and posts that cannot be relocated / eliminated. This may reduce the impact force which the rider experiences during an impact.
- Add flexible w-beam guard fence with motorcycle underrun protection
- Install motorcycle friendly sign support poles \* (e.g. plastic break-away, rubber self-righting or flexible posts).

\* Note: The term "frangible" usually denotes break-away upon impact from a car/truck. Most "frangible" posts/poles are not frangible for motorcyclists.

### 2.2. Safety Barrier

Safety barriers can provide significant safety benefits for motorcyclists by stopping other vehicles entering their lane (e.g. central barrier systems) or by providing energy absorption and redirection (e.g. motorcycle friendly barrier system products) for an errant rider that would have otherwise collided with fixed objects (e.g. trees, rocks, poles, etc.).

There are three categories of road safety barrier systems: flexible (flexible w-beam and wire rope safety barriers), semi-rigid (Type B W-Beam) and rigid (concrete barriers). Each of these systems is needed in different road environments and the consideration of motorcyclist risk should be included when deciding on barrier type.

The barrier type that results in the lowest impact force for a motorcyclist is a flexible w-beam system with underrun protection. However, most barrier type can be modified/retrofitted to lessen the risk for motorcyclists.

#### Treatment Options:

- Locate safety barriers away from the running lane
- Install barrier underrun protection (flexible w-beam and Type B)
- Factor motorcyclist risk into the selection of safety barrier type
- Remove or protect road safety barrier catch/snag points
- Install post protectors on wire rope safety barriers on popular motorcycle routes, especially where the risk of post impact is high such as in curves.

#### Example of good practice



Photo Source: Ingal Civil Pty Ltd



Photo Source: Safe Direction Pty Ltd



Photo Source: Ingal Civil Pty Ltd

#### Example of incorrectly installed under-run protection



Photo Source: Warren Blandy



Photo Source: Warren Blandy



## 3. Road Surface

### 3.1. Deformation (shove) / Rutting / Potholes / Edge Drop-Off / Cracking

Any surface issues have the potential to destabilise a motorcycle. Surface issues on a curve or in braking zones are particularly hazardous for motorcyclists.

When patching of a road surface is performed, the seams of a patch are areas where future road surface issues are likely to arise. These seams are often located along motorcyclists travel line.

#### Treatment Options:

- For popular motorcycle routes an altered maintenance program may be required, especially in the lead up to and during the riding season (September - March).
- When undertaking patches/dig-outs, aim for full width patching to avoid longitudinal seams in a motorcyclist's wheel path.
- Minimise or eliminate edge drop-off on popular motorcycle routes.
- Appropriate warning signs should be used until repairs are carried out.
- Avoid excessive crack-sealing on curves and consider resurfacing if large amounts of crack sealing is present on a road.

#### ! Note:

- Some surface issues present a high risk for motorcyclists even though they are not categorised as a 'hazard' in the Road Management Plan. Motorcycles are more sensitive to surface defects and hazards than passenger vehicles.
- Deformations (under a 3m straight edge) and potholes or edge-drop offs as little as 25mm, particularly in curves and braking zones, have been shown to destabilise a rider in some situations.
- Ruts and corrugations can also collect water during rainfall which further increases the risk for riders.

#### Example of issue

##### Rutting



Rutting can destabilise a motorcycle especially on curves where traction is important to be able to navigate a curve safely.

Photo Source: Safe System Solutions Pty Ltd

##### Edge drop-off



Edge drop-offs can make it difficult for motorcyclists to rejoin the road if they have inadvertently travelled off the road.

##### Cracking



Road surface cracking can negatively affect a motorcycle's stability and braking performance due to a loss of traction.

##### Patching



Patching can result in a change in road surface level and friction both of which can negatively affect a motorcycle's traction and stability, especially in curves.



Explanatory video: [Surface Issues](#)



### 3.2 Gravel

Gravel and loose stones can come from unsealed side roads, entrances, shoulders, wayside stops and spillages from trucks. Gravel reduces the tyre grip which is a hazard for motorcyclists.

#### Treatment Options:

- Seal bell mouth / side road / shoulder to prevent gravel being tracked onto the road, especially at curves and in braking zones.
- If the gravel cannot be immediately removed or an area of frequent gravel build-up cannot be eliminated, install warning signs to alert motorcyclists to gravel / loose stones on roads.
- Prioritise maintenance programs on motorcycle routes after rain/storm events to reduce gravel deposits on roads.

### 3.3 Vegetation Debris

Debris from overhanging and roadside vegetation can build up over time on the road surface. It can also collect quickly during a storm or in strong winds. Large tree leaves are a particular problem when they drop onto the road surface.

#### Treatment Options:

- Prioritise maintenance regimes for popular motorcycle routes to reduce vegetation debris on roads
- Selection of vegetation/ landscaping at road design stage should consider motorcyclists.
- Undertake ad-hoc inspections and/or debris removal following extreme weather (e.g. high wind events)

#### Example of Issue

Photo Source: Wendy Taylor



The build up of vegetation debris results in a slippery surface for motorcyclists, especially in the wet.



Loose gravel and stones are a hazard for motorcyclists as they can result in a loss of traction.

#### Example of good practice: Sealed Bell mouth



Sealed bell mouths can significantly reduce gravel carry-over.



## 4. Work Zones

### 4.1. Loose Material / Rough Surface

Loose gravel and other material can be scattered on the road surface and mud and other debris can be dropped from construction vehicles onto the road. This can result in a loss of grip for motorcycles and may cause loss of steering and braking control, potentially resulting in a crash.

#### Treatment Options:

- Clean up and remove loose material on road surfaces during and after road works.
- Place warning signs during works where the surface is not in good condition.
- Check contractors remove all materials from the road and road environment at the completion of a road or when the road is opened to vehicle traffic.
- Require wheel washes before vehicles leave muddy construction sites.

#### Example of Issue



Photo Source: Safe System Solutions Pty Ltd



Photo Source: Wendy Taylor

Loose gravel and other material from work zones should be removed frequently and regularly.

Place warning signs where the road surface near construction zones is not in good condition.

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Loose gravel and other material can be scattered on the road surface and mud and other debris can be dropped from construction vehicles onto the road.

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Explanatory video: [Work Zones](#)



## 4.2. Temporary Reinstatement (metal cover)

### Description of Issue:

Large metal plates placed in the road are slippery for a motorcycle or scooter and become even more hazardous when wet. The different surfaces may also create drainage issues, form gaps and accumulate debris. Raised bolts and sharp edges on the metal plate are also a hazard for motorcycles, and a snag point for errant riders.

### Treatment Options:

- Use a skid resistant coating on the metal surface (colour of the coating should contrast that of the surrounding surface where possible).
- Check for a flush match between the metal plate and pavement and eliminate or minimise exposed bolts and sharp edges.
- Place warning signs for motorcyclists upstream of the hazard.

### Example of Issue

Photo Source: Safe System Solutions Pty Ltd



Metal plates are slippery, especially in the wet, and can result in loss of traction for motorcyclists. Protruding bolt heads can puncture motorcycle tyres resulting in a loss of control.



Metal plates are slippery and are a hazard especially in areas where motorcycles are turning (i.e. leaning over) and braking.



### 4.3. Surface Condition During Works

During sealing or pavement works the road surface will be impacted. An uneven surface can cause a loss of stability and control for a motorcycle or scooter resulting in a crash.

#### Treatment Options:

- Implement rough surface signs and speed reductions when the road surface is impacted during works.
- Warn riders of the surface during aftercare periods, especially at night.
- Temporary lighting may be required where there is significant risk at a specific location.

#### Example of Issue

Photo Source: Safe System Solutions Pty Ltd



Rough surfaces in construction areas can result in a loss of traction for motorcyclists.

#### Example of good practice



Road surface around construction zones should be kept clear of debris and the road surface should be kept leveled. Provide adequate warning of construction zones to road users by way of signage and lighting.



## A Note on Audio-Tactile Line-Markings (ATLMS)

**Audio Tactile Line Marking (ATLM) is the combination of painted line marking and raised profile thermoplastic ribs to provide greater lane delineation and a sensory indicator (both tactile and auditory indicators) of lane departure (crossing edge line or crossing centre line).**

ATLM is also referred to as raised profile edge line or centre line, tactile edge lines or tactile centre lines, rumble strips or audio tactile profiled (ATP) road markings.

ATLMs are designed to reduce run off road and head on crashes by alerting a vehicle's driver that their vehicle is departing its travel lane and

is usually due to driver inattention or fatigue. This then allows the driver to take corrective action and bring the vehicle back into the travel lane.

ATLMs are generally installed on straight section of roads where driver inattention and fatigue are likely to occur. The installation of ATLMs on winding roads and winding roads with narrow lane widths should be carefully considered as this can generate excessive noise and vibration.

A concern raised by motorcyclists is whether ATLMs have a negative effect on motorcycle stability. To address this concern, a study was conducted by the New Zealand Transport Agency in 2013 and found that ATLMs do not

significantly contribute to motorcycle instability. A similar study conducted by Transport for New South Wales in 2019 also concluded that ATLMs on straight road segments and in tight curves (in both wet and dry road conditions) do not significantly contribute to motorcycle instability. However, ATLMs are a raised surface and, as such, the installation along popular motorcycling routes should be considered with care and consultation with stake holders.



*Photo source: Safe System Solutions Pty Ltd*

# References / Acknowledgements / Resources

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## Acknowledgements

- This guide was funded by the [Motorcycle Safety Levy Fund](#).
- Safe System Solutions were involved in the preparation of this guide.

## Additional Resources

- Australasian Road Safety Research, Policing and Education Conference
- [Crash characteristics and causal factors of motorcycle fatalities in Australia](#)
- [Reducing Motorcycle Crash Risk and Severity](#)
- [VicRoads Motorcycle Safety Website](#)

## Videos

- 1 [Tram Tracks](#)
- 2 [Pit Lids](#)
- 3 [Kerb Types](#)
- 4 [Visibility](#)
- 5 [Advisory Speed Signage](#)
- 6 [Cross-fall](#)
- 7 [Delineation](#)
- 8 [Intersections](#)
- 9 [Surface Issues](#)
- 10 [Work Zones Combined Video Playlist](#)



# Prompt List

The following prompt list has been created to assist with designing and maintaining roads so that they consider the needs of motorcyclists.

## Road Design & Road Surface

- Are pit lids located away from vehicle travel lanes? If this is not possible, do the pit lids have a skid-resistance surface?
- Are shoulders sealed, especially in curves?
- If kerbs have been specified, should they be of the mountable type?
- Is there a change in road surface type (i.e., friction level)?
- Is there a clear view for road users at roundabouts?
- Is there a clear view for road users at intersections?
- Is there a clear view for road users on curves?
- Does the design avoid compound curves?
- For passive intersections, are the sightlines clear of obstructions?
- For passive intersections, is the speed of the priority road appropriate from a Safe System perspective?
- Can intersections be controlled with traffic signals?
- Can median breaks be closed?
- Are bell mouths, side roads and shoulders sealed to minimise gravel carry over?

## Roadside Design

- If vegetation is specified, will it impair sightlines when matured?
- If there are multiple signs present, can they be consolidated?
- Has the use of plastic break-away, rubber self-righting or flexible posts been considered for signs?
- Would special motorcycle high risk warning signs assist motorcyclists?
- Are intersections well-lit at night?
- Are there roadside hazards that can be moved or removed? If not, should an appropriate guardrail and rub rail be installed?
- Can motorcycle friendly underrun protection (e.g. rubrail) be installed where guardrails are present?

## Road Maintenance

- Is the road surfaces along and around tracks unbroken?
- Is the road surface along and around tracks level with the tracks?
- Will a warning sign assist a motorcyclist in areas where tracks are present?
- Are pit lids cracked?
- Is there road surface cracking around pit lids?
- Do pit lids have a skid resistance surface?
- Has loose aggregate been removed from the road?
- Has loose aggregate been moved away from the road, especially in curves where they may blend in with the road surface colour?
- Can metal signposts be replaced with plastic break-away, rubber self-righting or flexible posts?
- Are compound curves signposted?

- Can motorcycle friendly underrun protection (e.g. rubrail) be installed where guardrails are present?
- Is rutting present? If so, can this be corrected?
- Is cracking present? If so, can this be patched?
- Is patching level with the road surface and of similar friction value?
- Is the edge drop off sufficiently low so that a motorcyclist can safely steer an errant motorcycle back onto the road?
- Are bell mouths, side roads and shoulders sealed to minimise gravel carry over?
- Are regular inspections of the roads scheduled, especially during September to May?
- Is vegetation regularly removed, especially during September to May?
- Are the roads inspected after rain or storm events?
- Does vegetation need trimming so that motorcyclists are not obscured?

## Work Zones

- Is loose material on road surfaces regularly removed during and after works?
- Are warning signs needed to warn riders of poor road surface conditions?
- Are wheel washes required when vehicles leave the construction zone?
- Do metal covers have a skid resistance surface?
- Can protruding bolts be eliminated?
- Is temporary lighting required, especially in areas of significant risks?





