INSTITUTE OF HIGHWAY ENGINEERS

Guidelines for **Motorcycling**

8 Road Safety Audit

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Road Safety Audit

8.1 Summary

There is no exhaustive checklist for taking responsible account of PTWs in Road Safety Audit ("RSA") work. Nor does anyone expect a Road Safety Auditor to undertake motorcycle training in order to understand the needs of riders. Gaining a better understanding of the safety problems likely to face motorcyclists must, however, involve awareness of:

- the common characteristics of motorcycle collisions;
- the more severe implications for riders of hazards that affect all road users;
- the road dynamics of motorcycles and the safety implications of their relationship to road surface properties, street furniture and obstructions;
- the different problems faced by riders in urban and rural environments;
- the need to inform RSA practice through discussions with local motorcycle forums or internal discussions with colleagues who ride; and
- the benefits of a rider's advice for the audit team on larger schemes.

8.2 Context

Road Safety Audits (RSA) began in the late 1980s and audits of trunk road and motorway schemes have been mandatory since 1991. Many local authorities also carry out such design-independent audits using the trunk road standard contained in the Design Manual for Roads and Bridges HD 19/03 (DfT 2003) or the guidance given in the IHT document Road Safety Audit (IHT 2008). Practical Road Safety Auditing – 2nd Edition (TMS 2008) also provides helpful advice on the basics of RSA practice.

Under the HD19/03 standard, the RSA process involves an audit of four key stages:

- Preliminary design stage;
- Detailed design stage (prior to starting construction);
- The stage prior to opening to traffic (or after finishing construction if it is not possible to keep the scheme closed to traffic); and
- One and three years after opening.

Good highway and traffic engineering practice separates safety auditing and user auditing. The latter focuses on improving infrastructure provision for sustainable modes in order to encourage modal shift. However, it is good practice for safety auditors to take a multi-modal approach to the process, giving special attention to safety implications for vulnerable road users such as equestrians, cyclists and

pedestrians. Motorcyclists sometimes suffer a lower profile in this 'vulnerable user' category because their higher speeds may lead auditors to put them into the same category as twin-track motor vehicles. This is a serious misunderstanding. The dynamics of motorcycles and vulnerability of their riders make motorcycling a unique mode within the traffic mix which requires separate and informed consideration by designers and auditors.

The safety auditor's prime objective is to examine the safety of a new scheme from a holistic viewpoint. The auditor's goal should be to seek an optimal balance of risk across all modes using experiential and empirical judgement to identify hazards, quantifying risks and estimating outcomes, both in terms of numbers and severity.

This chapter does not present motorcycles as a special case but seeks to emphasise to RSA practitioners (with little or no experience of motorcycling) how the balance of risk significantly shifts between two wheels and four.

8.3 Collision Characteristics

Chapter 1 demonstrates that the road safety problem for motorcyclists differs sharply according to their environment. The typical urban motorcycle collision involves another vehicle, usually at a junction, and often when the motorcyclist has priority. The rural situation could not be more different. Often no other vehicle is involved and the location is away from a junction, typically on a bend. Contributory factors that increase the likelihood of such collisions are equally diverse. This chapter will deal with these diverse factors of critical interest to the safety auditor.

8.4 Dynamics

The auditor must be alert to the implications of motorcycles' unique dynamics which are key to optimising motorcyclists' safety. A non-motorcyclist might suppose that "motorcycles accelerate faster than cars and can avoid traffic queues." Whilst this is true, auditors need to be aware of other serious yet subtle differences when balancing risks. It should always be foremost in an auditor's mind that a 'low risk, low severity' hazard to a twin-track driver may present 'a low risk, high severity' hazard to a motorcyclist.

Most of the important dynamic differences between motorcycles and other vehicles arise from the way motorcycles use the 'laws of physics'. For example, no other motor vehicles have wheels that can, and indeed must, move significantly out of the vertical to enable manoeuvres such as cornering. At speed, the wheels behave like two large gyroscopes, adding a further dimension to their physical properties. A skilful rider can make good use of this gyroscopic effect. A novice may experience unexpected effects. For example, on bends, applying the front brake can cause the machine to 'sit up' and take a line tangential to the bend. Predictable and consistent bend geometry is therefore critical to rider safety. Those involved in providing or maintaining the road infrastructure must understand that a motorcycle is by no means a 'fast bicycle' or a 'two-wheeled car'.

8.5.1 The line that motorcyclists take through bends and junctions

Motorcyclists must avoid:

8.5.1.1 Service covers and gully grating

Locating ironwork such that it avoids the wheel tracks of twin-track vehicles or on the outside of bends can inadvertently place them directly on the line used by motorcycles. This sudden change in road surface properties leads to stability problems. It should also be noted that water on service covers freezes faster than water on the surrounding road surface. If the cover cannot be relocated, it should have a surface finish compatible with the skid resistance of the surrounding road.

8.5.1.2 Large areas of road marking

Thermoplastic road marking material should be laid to an acceptable standard of skid resistance and retro-reflectivity. Further, road marking maintenance levels should reflect the fact that values often fall long before the road surface requires maintenance (see below). Large areas of such markings can present a serious safety hazard to motorcyclists. This risk must be balanced against a realistic assessment of any road safety benefits of using large areas of road markings.

8.5.2 The ‘clear zone’ around the outside of bends

This must be kept clear of:

8.5.2.1 Unprotected street furniture

Best practice in street scene management requires auditing of street furniture to assess whether, for example, signs can be rationalised into single assemblies in order to avoid a proliferation of posts. This should be taken a stage further, with signs not presenting a collision hazard for a falling motorcyclist. If it is unavoidable to have street furniture in the ‘clear zone’, every effort should be made to make it as ‘impact friendly’ as possible.

8.5.2.2 Safety barrier products that have only been tested on twin track vehicles

These can represent a serious hazard to a dismounted rider. More investigation is needed into aftermarket collision mitigation measures in locations where there is a higher risk of motorcycle loss of control (Chapter 3).

8.5.3 The effects of unpredictable surface irregularities

This may include:

8.5.3.1 Poor surface tie-in

This problem can mildly irritate a twin-track vehicle driver, but potentially cause a motorcyclist to suffer a sudden shift in balance, lose control and crash. Whenever possible, tie-ins should be perpendicular to the direction of, and across the whole width of, the carriageway and away from bends for which PTWs lean to negotiate.

8.5.3.2 Poorly designed or located traffic calming features

Motorcycles are machines that, to a point, become better balanced with increasing speed. Conversely, travelling at low speed can be more demanding of the rider and machine. Poorly located, designed or maintained traffic calming features can contribute to loss of balance, reduced control or even a crash (see Chapter 3).

8.5.3.3 Areas likely to retain surface detritus

Vehicles tend to push surface detritus, chippings, broken lens glass etc into areas of the road they do not use. Motorcyclists may use these areas because it forms their ‘correct line’ or because heavier traffic has pushed them there. In either case, motorcycles require the road to facilitate grip or braking and areas covered in road detritus facilitate neither (see Chapter 6).

8.5.3.4 Poorly designed drainage

Motorcyclists suffer sooner and more severely when surface water is not dealt with by carriageway drainage systems.

8.5.4 The importance of consistent skid resistance properties

8.5.4.1 Terminating antiskid surfacing on straight sections

Sudden changes in road surface properties on bends or junctions, especially skid resistance, can lead to stability problems as the rider tries to manage the change in dynamics and the response of the motorcycle. The transition between anti-skid surfacing on a bend and the adjacent straight section should therefore be on the straight section prior to the point where the motorcycle leans in order to negotiate the bend. These points are easily ascertained by on site observations of passing motorcycles.

8.5.4.2 Not using road markings or materials too close to bend

This includes:

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- Dragon’s teeth markings
- Speed limit roundels or other surface ‘signs’
- Transverse markings or “jiggle” bars.

In terms of sudden changes in road surface properties, remember that road markings rarely have the same skid resistance value as the surrounding road surface. Markings in areas of the road likely to be used for braking or cornering by motorcyclists can significantly increase the risk of stability problems. Relocation of the markings avoids loss of the general road safety benefit altogether.

8.5.4.3 Using road-marking material which has an acceptable level of skid resistance for the life of the marking

This means:

- Using profiled lining instead of flat lining
- Using material that has a similar skid resistance to the surrounding surface
- Using material that has retro-reflectivity to enable a rider to maintain good forward visibility at night and in the wet when riding conditions and retroreflectivity are typically poor
- Setting high, achievable standards for retro-reflectivity and skid resistance and testing this
- Using new marking materials and application methods, for example polymethylmethacrylate materials, which maximise good skid resistance and maintenance of retroreflectivity levels. The extra cost of these materials and methods should be assessed against the increased risk of injury and collisions.

8.5.5.4 Measures to mitigate problems caused by mud or leaves on the road

This should include:

- Locating new field access points away from bends and junctions;
- Considering 'leaf fall' when designing landscaping and the 'soft estate' in any new schemes; and
- As only a last resort, providing warning signs at locations where mud is likely to be a recurring problem.

8.5.5 The need for street lighting

Motorcycle headlights can be less powerful than other motor vehicles.
Refer to guidance from the local authority street lighting team or the Institution of Lighting Engineers (ILE 1995).

8.5.6 The eye height of a motorcyclist is much higher than a car driver

A higher sight line is beneficial for viewing the road ahead and any developing traffic. However, at RSA Stage 2 and Stage 3, it is vital to remember the motorcyclist's increased eye height. An object may not obstruct a car driver's view, but can obscure visibility for riders and other traffic with similar eye heights.

8.6 Urban Schemes

Motorcycle collisions in urban areas typically involve another vehicle and often occur in situations where the rider has priority. It is therefore essential to check that:

- side-road sight lines for emerging drivers at junctions do not 'hide' motorcycle riders, especially those on lower powered machines, who tend to ride nearer to the kerb
- skid resistance at junctions is appropriate, especially where a change in junction control is being made (eg from a priority junction to a signalised junction).

- lane widths are appropriate, particularly nearside lanes on multilane single and dual carriageways. This is important in areas subject to a 40mph speed limit, where mopeds (limited to 30mph) can be 'swamped' by passing traffic and where there are high numbers of HGVs.
- traffic calming schemes take account of the needs and vulnerabilities of motorcyclists (Chapter 3).

8.6.1 Rural Schemes

Rural motorcycle collisions often involve no other vehicles, and frequently occur on bends. Check for:

- Location of service covers and their skid resistance (see 8.5.1.1).
- Road markings (see 8.5.1.2 and 8.5.4.3). Reduced effectiveness of motorcycle headlights makes night-time retroreflectivity performance of road markings in rural areas especially important.
- Cross-sectional profile. This issue can be particularly unforgiving for motorcyclists. Cornering on a motorcycle, especially at rural road speeds, involves a degree of planning, skill and technique. If the cross-sectional profile of the road does not conform to expectations, the rider may not have time to make the necessary fadjustments and crash.
- The 'clear zone' on the outside of bends is especially pertinent in the rural environment (see 8.5.2).
- Excessive visibility to the right on high-speed approaches to rural roundabouts. This is a safety issue for all road users and is not catered for in the current design standard. It also has two implications for motorcyclists:
  - When the motorcycle is the approaching vehicle, it can encourage excessive entry speed and lead to 'loss of control collisions'; and
  - When the motorcycle is the circulating vehicle, it can encourage other drivers to use excessive approach speeds, increasing the chance of drivers 'looking but not seeing' and an entering circulating collision.
- The extent of 'offside deflection' on rural high speed roundabout approaches, especially on dual carriageways. The current design standard provides mandatory values for deflection based on entry path curvature – a line intended to emulate the easiest route through a junction, ignoring lane markings. This works well when vehicles can choose such a path. However, under modern traffic conditions riders (and drivers) often use the offside lane when the nearside lane is occupied by slower vehicles. This can lead some drivers and riders to collide with the central island. Implementing the advice in section 7.17 of the standard should reduce this problem (DTp 1993).
- A sealed surface at an appropriate distance back from the highway in order to prevent loose material collecting on the road.
- In recent years, a number of local authorities in England have implemented area-wide 20mph limits in an effort to reduce vehicle speeds in predominantly residential areas. This mechanism also seeks to change driver/rider attitudes to speed in urban areas. The DfT has issued a special direction that allows the use of repeater signs in 20mph zones (instead of physical measures) provided that at least one physical measure exists in the zone. These area-wide schemes aim to create conditions in which drivers and riders naturally drive at around 20 mph. Lowering the speed limit improves road safety by reducing the severity and frequency of all collisions, including those involving motorcyclists.

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