

CYCLISTS AT CROSSINGS

Report prepared for

VicRoads







ViaStrada Ltd

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Summary

This report investigates international practices and studies regarding the use of pedestrian crossings by cyclists. Its purpose is to advise whether Australia should amend its road rules to allow this practice. Three types of crossings are considered: unsignalised crossings (such as zebra crossings), signalised mid-block crossings and signalised intersection crossings.

Many different rules and standards exist throughout the world regarding this topic. In most countries, cyclists are not authorised to cycle on pedestrian crossings. Some European countries have a cycle equivalent of a zebra crossing, where cyclists are entitled to cycle across a road at the crossing and are given right of way over motorists.

Zebra crossings are the most common type of unsignalised mid-block crossing, although they take many shapes and forms between and within different countries. The report concludes that since not all zebra crossings are safe for pedestrians, they would probably not be for cyclists either. Thus it is not recommended that a law change allowing cyclists to ride across all existing zebra crossings be introduced. Alternative designs are proposed for unsignalised shared and segregated crossings which cyclists may ride across.

Signalised crossings at intersections where filter turning of motor vehicles is allowed (a common practice in Australia) are also deemed hazardous for cyclists (and pedestrians). It is recommended that measures be taken to improve the safety of pedestrian crossings in the presence of filter turns before any law change allowing cyclists to ride across signalised intersection crossings can be made. There should however be the option of allowing the use of these crossings by cyclists where appropriate signal hardware and phasing logic is provided.

It is suggested that allowing cyclists to ride across signalised mid-block crossings could be safely authorised by appropriate law changes. However, it may be necessary to consider methods of distinguishing between mid-block and intersection crossings for cyclists, so that riding across unsuitable signalised intersection crossings does not increase.



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1 Introduction

ViaStrada Ltd has been commissioned by VicRoads to assess the merits of changing the Australian road rules to allow cyclists to ride across signalised or zebra pedestrian crossings.

This report expands on Tony Barton's discussion paper "amendment to the national road rules to allow cyclists to ride across signalised and zebra crossings" by examining international regulations, studies and best practice.

Currently, Australian road rules prohibit cyclists from riding across any crossings except those with cycle lanterns. The discussion paper suggested that these rules limit the access and mobility of cyclists and sought a change in the rules. The paper presented a review of the behaviour of cyclists and motorists at 10 signalised crossings and one zebra crossing in Melbourne.

A proposal that the Australian road rules be changed to allow cyclists to ride across zebra and signalised crossings was presented to the Australian Bicycle Council (ABC), the Victorian Bicycle Advisory Council (VBAC) and the Australian Road Rules Maintenance Group (ARRMG). The last group was the only one to oppose the proposal, citing four objections, which, along with the discussion paper's rebuttal are presented in Table 1:

Table 1: Discussion paper's assessment of ARRMG's objections to proposal

| ARRMG's Objection | Discussion Paper's Assessment |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> Motorists would not have sufficient time to give way to cyclists who might ride onto a "zebra" crossing at speed. | <p>Under the Road Rules, pedestrians are not required to stop and make sure that motorists have stopped before crossing a "zebra" crossing.</p> <p>This implies that a walking or a running pedestrian is permitted to simply walk or run across the crossing at any time without giving motorists any warning of their presence.</p> <p>In reality, most pedestrians at "zebra" crossings stop and wait until motorists had stopped before crossing the road. Cyclists would do the same and, as a result, this is not considered a valid objection.</p> |
| <ul style="list-style-type: none"> Cyclists travelling along the left of the road would then suddenly cross the road at a crossing in front of motor vehicles. | <p>The results of the crash review showed that no crashes occurred at the crossings studied which would indicate that this behaviour is not a safety risk.</p> <p>In addition, the proposal would not be considered to increase the chances of this occurring.</p> |
| <ul style="list-style-type: none"> Pedestrian crossings standards are based on the requirements of pedestrians and these standards would need to be revised to allow cyclists to ride across crossings. | <p>Current standards and guidelines should provide adequate guidance on sight distance requirements for all crossings.</p> <p>It is considered appropriate that these standards and guidelines be reviewed if cyclists are permitted to ride across signalised and "zebra" crossings.</p> |
| <ul style="list-style-type: none"> It would be unsafe for pedestrians if cyclists were permitted to cross at these crossings as well | <p>Cyclists and pedestrians currently share off-road paths and there are no records of crashes on these paths between cyclists and pedestrians.</p> <p>On this basis, it is not considered unsafe for cyclists and pedestrians to share the use of pedestrian crossings.</p> |



2 Scope of this report

This report expands on the discussion paper and especially addresses the concerns of the ARRMG. Best practice examples, research and opinions from other countries are presented.

It is first necessary to acknowledge that the consideration of “cyclists using crossings” covers a wide range of situations.

2.1 Crossing entry locations

Two distinct situations of the entry locations from which cyclists wish to use existing pedestrian crossings should be considered – on road and off-road.

The exit points are comparatively less important, since traffic is stationary when cyclists reach the end of a crossing, making it easy for cyclists to either join a traffic lane or to continue along an off-road path.

2.1.1 Cyclists entering from off-road paths

It is likely that cyclists will enter crossings in a similar manner to pedestrians – via the footpath. This could be due to cyclists coming from off-road paths (either shared-use or dedicated cycle paths) or by moving from the road to the footpath to wait at the kerb.

It is possible that cyclists may be travelling at speed if they are coming from an off-road path, which is a concern raised by the ARRMG.

2.1.2 Cyclists entering from the road

It is also possible that cyclists who are travelling along the road (either in mixed traffic or exclusive cycle lanes) would wish to use existing pedestrian crossings (either to enter an off-road path or to access property on the other side of the road or do a U-turn and continue along the road in the opposite direction).

In this situation cyclists would have to turn 90 degrees and may enter the crossing from the road, rather than the kerb. The ARRMG identified this situation as being potentially hazardous given that cyclists may not give adjacent or following motorists sufficient warning that they wished to use the crossing.

2.2 Types of crossings

Four main types of crossings exist:

- Unsignalised crossings (zebra or tiger, for example);
- Signalised mid-block crossings;
- Signalised crossings at intersections; and
- Exclusive cycle crossings.

Each of these types has multiple derivations and certain situations where they are most applicable. The first three are generally reserved for pedestrians only and the last is obviously for cyclists only. Exclusive cycle crossings could be regarded as a subset of the other two mid-block types, but there are some interesting international examples, which warrant these to be listed separately.



2.3 Possible conflicts

Two main conflict types should be considered for cyclists riding across pedestrian crossings:

- Conflict between cyclists and pedestrians using the crossings; and
- Conflict between cyclists and motorists.

The potential for conflict between pedestrians and motorists is obviously already a consideration of the pedestrian crossings, however a secondary effect of pedestrians avoiding conflict with cyclists may be that they increase their risk of conflict with motorists; this should also be considered.

3 Current international laws

3.1 'Zebra' and other unsignalised pedestrian crossings

Zebra crossings are the most common unsignalised crossing. They generally consist of painted white lines across the road accompanied by warning beacons at either end. Road traffic is required to stop if a pedestrian (or in some countries, a cyclist) is actively crossing.

In most countries, legislation does not allow for cycling across a 'zebra' crossing. There are however exceptions to this. There is an ever-expanding array of crossing facilities, and the times when there were just 'zebra' crossings are gone.

After some isolated experiments, 'zebra' crossings were first used at some 1,000 sites in the UK in 1949. They were originally marked with alternating stripes of blue and yellow. Conventional 'zebra' crossings were introduced into UK law in 1951 (Wikipedia 2007d).

Rule 64 of the British Highway Code says: "Do not ride across a pelican, puffin or zebra crossing. Dismount and wheel your cycle across" (Department for Transport 1988). The UK does have several "cycle zebras". This term may be confusing as it does not refer to zebra crossings that cyclists are allowed to ride on but merely zebra crossings with cycle tracks at each end; cyclists using the cycle tracks must still dismount and walk across the actual crossing.

Tiger crossings were an experimental facility in the UK, where the stripes were painted yellow as opposed to the white used on a zebra crossing. They allowed cyclists to ride across the road and motorists were required to give way to both cyclists and pedestrians. Tiger crossings were trialled in Aylesbury district but were replaced with Toucan (see section 3.3) crossings (Wikipedia 2007b). Few references outlining the reasons for this could be found. Tiger crossings are no longer present anywhere and are not covered in the Highway Code.

In Finland, both cyclists and pedestrians have right of way on a 'zebra' crossing over other traffic (see Figure 1). "*If a crossing is an extension of a cycle track, cyclists may use it without dismounting.*" The type of 'crossing' is not defined in the source document, 'crossing' may refer to signalised crossings as well. It further says: "*Motorists must give way to pedestrians and cyclists already on a pedestrian crossing, even when turning.*" (Ministry of Transport and Communications Finland 2004)

In Vienna (Austria), there is a speed limit of 10 km/h for "cyclists on crossing not controlled by traffic lights or manual signals" (Vienna City Administration 2007). The type of 'crossing' is not defined in the source document.



The Swiss Highway Code (Federal Authorities of the Swiss Confederation 2002) does not mention cyclists at 'zebra' crossings (called 'Fussgängerstreifen' in the German version of their legislation). As cyclists fall outside of their definition of pedestrians, they don't have right of way at 'zebra' crossings in Switzerland.



The turning vehicle, in this case the car, must yield to the bicyclist who is driving across the crossing road.

Figure 1: Finland – car giving way to cyclist on 'zebra' crossing (Liikenneturva 2004)

The German road traffic legislation (Straßenverkehrs-Ordnung) defines the priority at zebra crossings (called 'Fußgängerüberweg' in the legislation) in paragraph 26 for pedestrians and wheelchair users. Cyclists are not included in this definition (Juris 2007).

In The Netherlands; *"Drivers must give way at all times to pedestrians and drivers of invalid carriages who are crossing, or obviously waiting to cross at a pedestrian crossing."* Cyclists are not covered in those rules. (Ministry of Transport and Public Works 2006)

In Sweden cyclists are not classified as pedestrians and hence are not allowed to ride across pedestrian crossings.

In North America, the various states all have their individual traffic legislation. In the state of Washington, both pedestrians and cyclists have right of way on a crosswalk (Access Washington 2007). The traffic laws of Illinois are silent with regards to cyclists using crosswalks (Cyber Drive Illinois 2007). In Colorado, riding a bicycle on a crosswalk is prohibited by law: *"No pedestrian shall suddenly leave a curb or other place of safety and ride a bicycle, walk, or run into the path of a moving vehicle which is so close as to constitute an immediate hazard."* (Office of Legislative Legal Services 2007)

In New Zealand, the Road User Rule (Land Transport New Zealand 2004) stipulates that drivers must give way to pedestrians, to riders of wheeled recreational devices or mobility devices at 'zebra' (or pedestrian) crossings. The definition of a 'wheeled recreational device' excludes bicycles with a wheel diameter exceeding 355 mm.

Kea crossings are New Zealand school crossings (sometimes used in conjunction with zebra crossings) where barrier arms are manually extended across the carriageway to allow pedestrians to cross. These are known as emu crossings in Australia. Koala crossings are another type of Australian school crossing where flashing lights are used during certain times to make motorists more aware that a school patrol is operating. Wombat crossings are zebra crossings on raised platforms with 40 km/h speed limits within 30-40 m of the crossing used in Australia. A Wombat crossing may also be fitted with flashing yellow lights.

New Zealand is currently trialling "dynamic crossings" where zebra crossings are bordered with flashing light studs that activate when pedestrians are detected to approach the



crossing. An example is shown in Figure 2. These trials have not concluded yet but it seems that countries such as Germany have had success with such crossings.



Figure 2: Dynamic crossing, Christchurch

3.2 Exclusive cycle crossings

Sweden has exclusive cycle crossings (see Figure 3) on which pedestrians are not allowed. Cyclists do not have right of way until they are on the crossing and therefore must wait for a gap in the traffic before beginning to cross. Signalised versions of the cycle crossing also exist (Vagverket 2004). It appears from Rasanen and Sumala (1998) that Finland has similar exclusive cycle crossings.

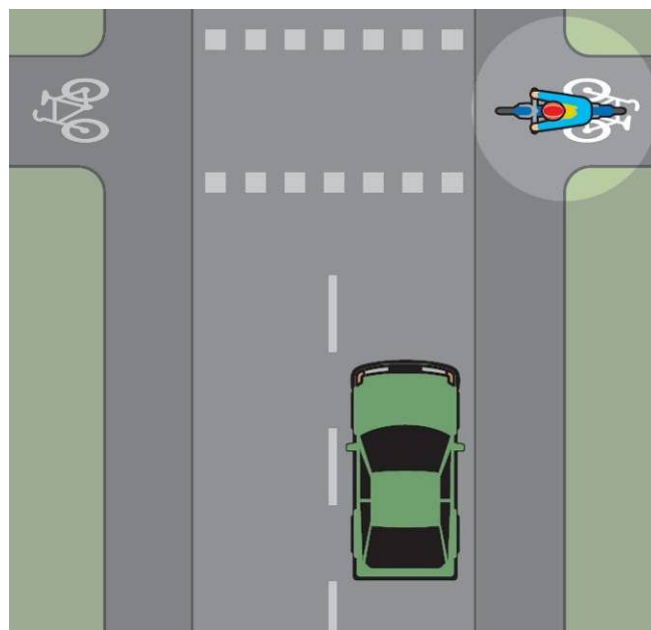


Figure 3: Swedish cycle crossing (Vagverket 2004)



Germany and Austria also have exclusive cycle crossings, which may be extensions of pedestrian crossings (Figure 4) or located separately (Figure 5) (Wikipedia 2007a). These are especially common in Germany at roundabout approaches.



Figure 4: German pedestrian and cycle crossing (Wikipedia 2007a)



Figure 5: Austrian exclusive cycle crossing (Youth Red Cross 2007)



Table 2 summarises this chapter and the previous chapter regarding international legislation of unsignalised pedestrian crossings and provision of exclusive cycle crossings.

Table 2: Summary of international legislation regarding unsignalised crossings

| Country | Cyclists given right of way when riding on unsignalised pedestrian crossings? | Provision of exclusive cycle crossings? |
|--------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| UK | No | Some “tiger” crossings were trialled but trial has been abandoned |
| Finland | Generally no, but yes when the crossing is an extension of an off-road cycle track or path. (?) | Yes |
| Austria | Yes (cycling speed limit of 10 km/h) | Yes |
| Switzerland | No | Apparently not |
| Germany | No | Yes |
| Netherlands | No | Apparently not |
| Sweden | No | Yes |
| USA | No (except in Washington State. In Washington cyclists are allowed to ride across crossings. | No |
| Canada | No | Apparently not |
| South Africa | No | Apparently not |
| New Zealand | No | No |

3.3 Signalised mid-block crossings

Pelican crossings (the official name is Pelicon crossing, short for **pedestrian light controlled** crossing, but the former spelling is now widespread) are signalised mid-block crossings, with the pedestrian signals mounted on the far side of the crossing (Wikipedia 2007b). Before the lights for motor vehicles go back to green, a flashing amber light is displayed and motorists can proceed cautiously while observing the right of way of crossing pedestrians.

Puffin (**pedestrian user-friendly intelligent**) crossings used in the UK differ from Pelican crossings in that the lights controlling the pedestrians are on the near side of the road, rather than on the opposite side. The mounting position is supposed to enable pedestrians to monitor passing traffic while waiting for the signal to cross, and assists visually impaired people who could have difficulty viewing the signal from across the carriageway. (Wikipedia 2007b)

Rule 64 of the British Highway Code stipulates that cyclists can not ride across a Pelican or Puffin crossing.

Toucan crossings used in the UK allow bicycles to be ridden across. A ‘green bicycle’ is displayed next to the ‘green man’ when cyclists and pedestrians are permitted to cross. The pedestrian/cyclist signals may be on the near side of the crossing (like a puffin crossing), or on the opposite side of the road (like a pelican crossing). They are operated



differently from pelican crossings because, since before the lights for motor vehicles go back to green, a steady red and amber are displayed. (Wikipedia 2007c)

Toucan crossings are also used in New Zealand, especially where off-road shared use paths cross busy roads. An example is shown in Figure 6. Similar crossings are also common practice in many European countries, although no specific legislation was found.



Figure 6: Toucan crossing, Christchurch, New Zealand

French signalised mid-block crossings (Figure 7) are accompanied by the same pavement markings used on zebra crossings. Cyclists are also allowed to ride on the crossings in the areas indicated with cycle markings. No studies on the safety of such crossings have been found.



Figure 7: French signalised mid-block crossing markings (courtesy of Roger Boulter)¹

Signalised mid-block crossings appear to be a common feature around the world, and generally, cyclists are accommodated at these installations.

3.4 Signalised crossings at intersections

According to traffic law in Florida, cyclists are allowed to cycle on a 'sidewalk' (i.e. footpath). *"At a signalized intersection, a sidewalk rider must obey the instructions of any applicable pedestrian control signal. That is, he may start to cross a roadway in a crosswalk only during a steady Walk phase, if one is displayed. If no pedestrian signal is provided, the cyclist may proceed in accordance with the signal indications for the parallel roadway traffic flow."* Hence, a cyclist has right of way when a pedestrian signal shows a steady green light. (Wikipedia 2007a)

In New Zealand, the Road User Rule defines right of way on a parallel crosswalk for pedestrians only (Land Transport New Zealand 2004). To achieve a legal crossing at a signalised cross junction, cycle signals have to be used and filtering traffic can not be permitted during the cycle phase (Wilke 2005).

4 International studies and anecdotal observations

4.1 General safety implications for pedestrians

Pedestrians are generally the most vulnerable road users and already experience many dangers when crossing. Fontaine and Gourlet (1997) showed that in France 50.3% of the 1,289 pedestrians killed in a year-long period were crossing a road. Young and elderly

¹ Note signal hardware not shown in photo



pedestrians were identified as having the highest risks. It is important to consider whether allowing cyclists to use pedestrian facilities or not will endanger pedestrians further.

Graw and Konig (2002) in an analysis of three fatal pedestrian-bicycle crashes in Germany concluded that in such crashes:

- The cyclist is generally to blame for crash;
- There are very low reporting rates for crashes not involving motor vehicles; and
- No indication of most common movement types (head-on, overtaking etc) was obvious.

The very small sample size of this research is not large enough for the drawing of meaningful conclusions, and the word 'generally' in their conclusions would need to be treated with caution. The research does suggest that cyclists sharing pedestrian crossings could increase the risks for pedestrians.

CAS (Crash Analysis System) records 4,573 fatal crashes in New Zealand for the period of 1996-2007 (that is, part of 2007). Of these, 546 were crashes between pedestrians and motor vehicles. Whilst there are no recorded crashes between pedestrians and cyclists, generally only crashes involving motor vehicles are entered into the database. The corresponding exposure of pedestrians to walking, motor vehicles and cyclists is not known. Turner *et al* (2006) surveyed 264 people from three New Zealand cities who were admitted to hospital due to road related injuries in 2002/2003. 63% of the injuries were due to conflicts with motor vehicles, 30% involved only pedestrians (e.g. due to trips or falls on footpaths) and the remaining 7% occurred between pedestrians and cyclists.

Living Streets UK are not in favour of shared cyclist and pedestrian crossings (Hebditch 2006). They believe that such facilities:

- Could lead to conflict between users;
- May increase vulnerability of pedestrians; and
- Could confuse drivers and decrease effectiveness of crossings over time.

Living Streets advocate that if cyclists are to be allowed to ride on crossings they should be segregated from pedestrians on and leading up to the crossings as well as being informed that they must give way to pedestrians in situations of conflict.

It should be noted that Living Streets UK's article referred to shared cyclist and pedestrian crossings as "cycle zebras". Their understanding was technically incorrect, as regulations for cycle zebras do not allow cyclists to ride across them. However, in practice cyclists often do ride across the zebras. Living Streets' comments should be seen in relation to shared cyclist and pedestrian crossings.

Living Streets Aotearoa's Executive director, Liz Thomas, said that the New Zealand branch does not have an official view on cyclists sharing pedestrian crossings. Her own personal view is that in some circumstances (for example where there is ample space and crossings are near shared paths) cyclists should be allowed to "share with care" the pedestrian facilities. (Thomas, *pers. comm.*)

While no information was available on the pedestrian-cyclist conflicts experienced at official shared cyclist and pedestrian crossings, much can be inferred from locations where pedestrians and cyclists do share facilities.

A very common facility used by both pedestrians and cyclist is the shared-use path (also known as multi-use, mutual use or diversified paths or trails). When Aultman-Hall and Hall (1998) evaluated the safety of commuter cyclists in Ottawa they found a total of 201 collisions reported from a sample of 1,604 survey respondents, with breakdowns of the



collision types as shown in Table 3. Mean collision rates, based on cyclist exposure, were also calculated, as shown in Table 4. The relative rates for collisions in the different environments were not considered to be statistically different but, based on falls and injuries the study concluded that cyclists were safer on road than off-road.

Table 3: Objects collided with by Ottawa cyclists (Aultman-Hall and Hall 1998)

| Object type | Number of collisions reported |
|-----------------------------------|-------------------------------|
| Car/ van | 115 |
| Truck | 4 |
| Bus | 3 |
| Bicycle | 31 |
| Pedestrian | 20 |
| Animal | 11 |
| Other (posts, fences, poles, etc) | 15 |
| Not stated | 2 |
| Total | 201 |

Table 4: Event rates for Ottawa cyclist collisions (Aultman-Hall and Hall 1998)

| Collision type | Mean event rate (event per 10 ⁵ km travelled) |
|----------------|-------------------------------------------------------------|
| All | 3.26 |
| Road | 3.23 |
| Off-road | 3.03 |
| Sidewalk | 3.04 |

In a similar study (Aultman-Hall and Kaltenecker 1999), found the number of crashes experienced by a sample of 1,196 commuter cyclist crashes from Toronto, as shown in Table 5.

Table 5: Collisions for Toronto cyclists (Aultman-Hall and Kaltenecker 1999)

| Collision with | Road | Path | Sidewalk |
|----------------|------|------|----------|
| Motor vehicles | 269 | 3 | 2 |
| Bicycles | 27 | 5 | 1 |
| Pedestrians | 24 | 6 | 1 |
| Other | 7 | 7 | 4 |

Although these data were based on a study of cycling, it gives some useful information on pedestrian safety. Table 4 shows that cyclists on off-road paths and sidewalks (footpaths) experience similar collision rates to cyclists on roads; Table 3 shows that collisions with pedestrians make up a large proportion (i.e. 10%) of these collisions. This value, however, is relatively low considering the total distance travelled by the cyclists surveyed. Obviously the volume of pedestrians present is also an important factor.

Aultman-Hall and LaMondia (2006) found that for the 684 people who used three shared use tracks in Connecticut during the autumn of 2002, pedestrians (not including skaters,



who had the highest collision rate) had by far the lowest collision rates. Falls were the most common form of injury for pedestrians. This suggests that pedestrians and cyclists are able to share common space safely.

The discussion paper from which this report stems cites a survey of ten signalised and one zebra crossing in Melbourne. A total of 2,823 cyclists used the sites over the survey period and all rode over the crossings. Corresponding pedestrian volumes are not known and conflicts were not surveyed. The combined survey time was 24 hours. It was stated that there is no record of any cyclist crashes at these locations, but it was not stated how long these crossings have been operational. As cycle and pedestrian crashes are relatively rare events, this study cannot be used to give statistically significant conclusions without further information.

“Cycle zebras” are becoming more common in the UK. These facilities are simply zebra crossings with cycle tracks or shared use paths at either end. Legally cyclists are required to dismount and walk across the crossing but, in practice, most generally ride across. Physical measures are usually implemented to ensure that cyclists have slow approach speeds.

A 12 hour survey of one such location in Hull (Figure 8 and Figure 9) showed 820 pedestrians and 480 cyclists use the crossing. The majority of cyclists ignored the “cyclist dismount” signs and rode across the crossing. 64% of drivers gave way to waiting pedestrians and 62% gave way to waiting (mounted) cyclists. No conflicts between cyclists and pedestrians were observed during the 12 hours. No crashes have been reported for the location since it was installed four years ago.



Figure 8: Dismounted cyclists using Hull cycle zebra





Figure 9: Mounted cyclist and pedestrians using Hull cycle zebra

A study on cycling in designated pedestrian areas (Department for Transport 1993) in England and Wales concluded that there was no justification for excluding cyclists from pedestrian areas and that to allow cyclists would greatly advantage them. The four main findings of the study were that:

1. While pedestrians change their behaviour in the presence of motor vehicles they do not do so in the presence of cyclists;
2. Cyclists modify their speeds and dismount where necessary in response to increases in pedestrian density;
3. Only one crash between a pedestrian and a cyclist occurred over the 15 site-years of the study; and
4. Segregating cyclists from pedestrians is advisable for particularly high flows of either pedestrians or cyclists.

While it was not indicated that any of the sites studied included road crossings it seems that the study provides useful information on the interaction of pedestrians and cyclists and that, when the two groups are sharing space, neither endangers or disadvantages the other.

Ker and Huband (2006) pointed out that often users perceive shared use paths to be more dangerous than they actually are. It was noted that it is important to educate users regarding the actual safety and regulations of such facilities.

Jacobsen (2003) showed that a “safety in numbers” effect exists for pedestrians and cyclists – the more users a facility has, the lower the crash risk per user. Thus, if allowing cyclists to cycle over crossings encourages more cycle use, it is conceivable that this would actually increase the safety to pedestrians as well.

4.2 General safety implications for cyclists

Cyclists themselves would conceivably be safer walking their cycles in a completely pedestrian environment than riding their cycles amongst pedestrians. However, cyclists of course choose to cycle for reasons of speed and convenience and the purpose of this study is not to judge the relative merits of cycling and walking. As identified in the previous section, cyclists endanger pedestrians more than pedestrians endanger cyclists, thus pedestrians are not considered to be a danger to cyclists.



Maki *et al* (2003) showed that, in Japan, the risk of sustaining a serious or fatal injury when colliding with a motor vehicle is lower for cyclists than pedestrians (no information was given on the relative frequencies of pedestrian-motor vehicle and cyclist-motor vehicle collisions).

Thus motor vehicles do not seem to be a threat to cyclists if they are acting in the same way as pedestrians. However, one of objections raised by ARRMG deserves special consideration in this section – that cyclists travelling along the left of the road would then suddenly cross the road at a crossing in front of motor vehicles.

While the discussion paper states that no crashes occurred during the study the sample size of the study was perhaps not large enough to infer that this situation would never happen (a study of conflicts rather than just crashes may have been more appropriate). It is feasible that cyclists, especially those with limited cognitive abilities, may feel they have the right to turn sharply onto a crossing and do not realise that motorists will not have time to stop. This would be similar to situations where zebra crossings have higher crash rates than unmarked crossings due to false perceptions of safety.

To prevent this it may be advisable to require that cyclists move from the roadway behind the kerb and proceed as pedestrians and off-road cyclists do.

4.3 Safety issues relating to specific crossing types

In addition to the safety concerns specific to pedestrians or cyclists, safety issues related to the type of crossing should be considered.

4.3.1 Safety of zebra crossings

Significant research into the safety of zebra crossings for pedestrians has been undertaken. Elvik and Vaa (2004), in their meta-analysis of 30 different studies on traffic control devices for pedestrians and cyclists showed that zebra crossings (without aids such as raised platforms or central refuges) have a crash risk to pedestrians 28% greater than if there had been no crossing.

This phenomenon is generally attributed to the attitudes of motorists and pedestrians towards zebra crossings. Motorists become used to driving past zebra crossings without pedestrians present and so don't expect to stop, especially if they are familiar with the road. Varhelyi (1998) suggested that motorists place the responsibility of stopping on pedestrians. Pedestrians, especially young or cognitively impaired people, may develop false perceptions of the safety of zebra crossings (Leden *et al* 2006) and do not understand that motorists require time to stop.

Elvik and Vaa (2004) also calculated that mid-block signals would reduce the crash risk by 12% and raised pedestrian crossings would reduce the crash risk by 49%.

Hatfield and Fernandes (2007) showed that Australian road users have a poor understanding of certain road rules. 70.6% of survey respondents believed that pedestrians have right of way while waiting to cross at a zebra crossing but this is not true (except for children's crossings) under Australian road rules.

Given this information, a question must be asked – is it worth even considering the safety to cyclists using zebra crossings if they will still be unsafe for pedestrians? It seems advisable to not allow cyclists to ride across standard zebra crossings and focus the attention of this investigation to other or modified crossing types.

Raised pedestrian crossings are expected to reduce pedestrian crashes by 49 percent and additional provisions of central refuges and guard rails are also expected to reduce



crashes (Elvik and Vaa 2004). Thus it may be more sensible to think about allowing cyclists to ride on crossings of a higher engineering standard.

ARRMG's first objection to the proposal of allowing cyclists to ride on pedestrian crossings was that motorists would not have sufficient time to give way to cyclists who might ride onto a zebra crossing at speed. The current Victorian road rules dictate that:

- 81(1) A driver approaching a pedestrian crossing must drive at a speed at which the driver can, if necessary, stop safely before the crossing; and
- 81(2) A driver must give way to any pedestrian on a pedestrian crossing.

The second rule shows that drivers are not required to give way to pedestrians waiting on the footpath to cross; they only have to give way once the pedestrian is actually standing on the crossing. As found by Hatfield and Fernandes (2007) few Australians are actually aware of this rule. As pointed out in the discussion paper, pedestrians are not required by law to stop before stepping onto the crossing.

According to the first rule, all traffic approaching a pedestrian crossing should be travelling at a safe stopping speed, regardless of whether or not it is obvious that a pedestrian will be crossing. In practice, drivers generally only travel at safe stopping speed if they believe they will have to stop because they can see a pedestrian. Thus, if the rules were changed to allow cyclists to ride over crossings with the same rights as pedestrians, although the rule would officially give cyclists right of way, in practice motorists would have to change their perception of situations in which they would be required to stop. Motorists would have to realise that cyclists travel at greater speeds than pedestrians (even those who are running) and therefore can cover greater distances in the same length of time, i.e. motorists would have to scan greater areas before deciding if they may have to stop at a crossing. It may take some time for motorists to realise this; engineering, education and enforcement would be key in supporting any regulation changes.

This scenario may also pose a problem for off-road tracks where visibility is limited and motorists may not see approaching cyclists. Technically the motorists should be travelling at safe stopping speed but in practice they may not. If a change of road rules is introduced an effort should be made to identify and rectify sites that do not provide adequate sight distance for motorists to see approaching cyclists.

While it is possible to install devices that decrease the approach speeds of cyclists, such as gates or chicanes, it may not be prudent to do so as cyclists may focus on manoeuvring around the devices and not pay enough attention to other traffic. If the laws are changed to allow cyclists to ride on pedestrian crossings, cyclists should be made aware of the exact implications of the law. Currently pedestrians only have right of way once they have stepped onto a zebra crossing. It may be advisable to give right of way to cyclists who have stopped immediately before the crossing to ensure they check for motor traffic and are cautious of their own safety. Alternatively, it could be required by law that cyclists riding on pedestrian crossings are subjected to a starting speed limit of around 8 km/h. While cyclists may not know exactly how fast this is they should understand that, for their own safety and the safety of other crossing users, they must start crossing slowly.

4.3.2 Safety of tiger crossings

Three tiger crossings were trialled in Aylesbury, UK. These consisted of 3 sections; the outer sections, for pedestrians, were traditional black and white stripes and the middle section, for cyclists, were amber and black stripes. Cyclists were permitted to cycle over the crossing but were still required to slow down while approaching and give way to traffic when they were not on the crossing. Additional signing and lining was designed to ensure cyclists and motorists understood and obeyed these rules.



The Aylesbury Council was instructed by the Department for Transport (DfT) to discontinue the trial, as it would otherwise require legislation changes. From contact with Darren Divall (*pers. comm.*) the cycling officer for Aylesbury, it appears that no formal studies were made on the effectiveness of the Tiger crossings (clarification of this has been sought but not yet received).

4.3.3 Safety of exclusive cycle crossings

Rasanen and Sumala (1998) studied the 188 bicycle-car crashes that occurred and were reported at crossings of cycle paths (called 'cycle tracks' in the research paper) and roads in Finland for the period of 1990-1994. The crossing types included pedestrian crossings, (which, as previously mentioned, cyclists are allowed to ride over in Finland), marked bicycle crossings and unmarked crossings. During the same time period 46 non-vehicle related crashes, including seven cyclist-pedestrian crashes, also occurred, but were not investigated further. No measures of exposure (e.g. number of cyclists passing through the sites) were given, so the safety of such crossings is not obvious, but information can be gained on the types of crashes expected at such crossings.

The researcher found that for 37% of crashes neither driver nor cyclist realised the danger or had time to yield. Of the cyclists who did notice the approaching driver, 92% believed the driver would give way as required by law.

Two common mechanisms underlying the crashes were identified:

- Attention was otherwise diverted such as that other parties were not detected; and
- Unjustified expectations about the behaviour of other parties.

One of the dangers of allowing cyclists to use pedestrian crossings (or exclusive cycle crossings) highlighted by the study was that two-way cycle paths (common in Finland) often result in cyclists coming from a direction that seems inconsistent to the motorist's expectations. This may be less of a problem in Australia where cycle paths are less common but it should be considered that cyclists wishing to cycle on pedestrian crossings will often come from off-road locations and may not conform to drivers' expectations.

Leden *et al* (2000) found that raising an exclusive cycle crossing in Sweden reduced motor vehicle speeds (as was expected) but also increased cycle speeds. The overall result was a 20% reduction in the crash risk to cyclists.

Correspondence with a road safety analyst from the Swedish Road Administration revealed that cycle crossings are not generally installed in the near vicinity of pedestrian crossings; there is no standard regarding how far apart the two can be. Cyclists are often observed to ride across pedestrian crossings as well but there are no data available regarding how often this occurs or conflict rates between cyclists and pedestrians (Lekander, *pers. comm.*)

4.3.4 Safety of mid-block signalised crossings

Mid-block signalised ("Toucan") crossings (where both pedestrians and cyclists can cross, sometimes in segregated areas) reduce pedestrian crashes by 12% compared to locations without crossing provision. Hence they are also much safer than zebra crossings for pedestrians in terms of the risk imposed by motor vehicles (Elvik and Vaa 2004). Cyclists sharing the pedestrian crossings should also be safer from motor vehicles. Thus the safety implications of allowing cyclists to ride across signalised mid-block crossings are governed by the safety of interactions between pedestrians and cyclists, which has been shown previously in this report to be negligible.

Combined pedestrian and cyclist crossings are already used in New Zealand and Australia and no recorded crashes have been found for these locations. Correspondence



with members of Living Streets Aotearoa suggests that pedestrians are quite happy to share such crossings with cyclists and in fact, most pedestrian advocates think it would be a good idea (Living Streets Aotearoa *pers. comm.*).



Figure 10: Signalised mid-block cycle crossing, Melbourne

4.3.5 Safety of signalised intersection crossings

Signalised intersection crossings (or “parallel crossings”) are very different to signalised mid-block crossings due to the involvement of turning vehicles. Australia, like New Zealand, commonly allows phasing arrangements with “filter turns” where vehicles are allowed to turn provided that pedestrians aren’t crossing at the time (in Britain pedestrians are given their own crossing phase, hence turning traffic will never interfere with crossing pedestrians).

In practice, filtering of vehicles through pedestrians can be very risky. Elvik and Vaa (2004) estimate that pedestrian crossings with mixed phases (i.e. filter turning) at signalised intersections increase pedestrian crashes by 12%, compared with pedestrian crossings with separate phases at signalised intersections, which decrease pedestrian crashes by 29%. Cyclists travel faster than pedestrians and may be less obvious to drivers attempting filter turns, thus use of parallel crossings by cyclists may be even more hazardous than for pedestrians.

Signal measures could be used to make parallel crossings safer for cyclists and pedestrians. Examples (listed in order of decreasing safety benefits) include:

- separate crossing phases rather than allowing traffic movements at the same time as pedestrians and cyclists are allowed to cross;
- ban the conflicting turning movement;



- longer partial protection (i.e. red turning arrows banning vehicles from turning that are then extinguished partway through the pedestrian clearance phase) where filter turning is allowed; and
- flashing yellow lights facing turning motorists, as used in Germany.

It is not recommended to allow cyclist to use pedestrian crossings without introducing one of these measures. Thus, for signalised intersection crossings, distinction should be made between those crossings cyclists can and cannot use. Ideally all crossings would be modified to ensure that pedestrians are also protected from the dangers of filtering motor vehicles; if this were so cyclists could be allowed on all parallel crossings.

5 Discussions and recommendations

The general conclusion of studies is that allowing cyclists to share pedestrian crossing facilities will not disadvantage pedestrians, it is even possible that the presence of cyclists will increase pedestrian safety through Jacobsen's (2003) "safety in numbers effect".

5.1 Unsignalised mid-block crossings

Standard zebra crossings have been proven to often be unsafe for pedestrians, unless for example, situated on raised platforms. Ideally for pedestrian safety, all zebra crossings of types that have poor safety records should have engineering measures applied to them. Exclusive raised cycle crossings used in other countries have also been shown to be safer than level cycle crossings. Law changes would also not necessarily influence motorist behaviour to adjust to looking for cyclists who have faster travel speeds than pedestrians. Thus it is recommended that the current law is not modified to allow cyclists to ride over all zebra crossings.

Instead, it is recommended that a new unsignalised crossing type be instituted in Victoria. This would be similar to raised zebra crossings but with distinguishing markings so that cyclists would know they could ride over them. A suggested layout is shown in Figure 11, where traditional zebra stripes alternate with cycle symbols. Some of these crossings may have segregated pedestrian and cycle sections to be used in areas where there are significantly high volumes of both pedestrians and cyclists. A suggestion for the markings of this type of crossing, based on those already in use in Europe, is shown in Figure 12.



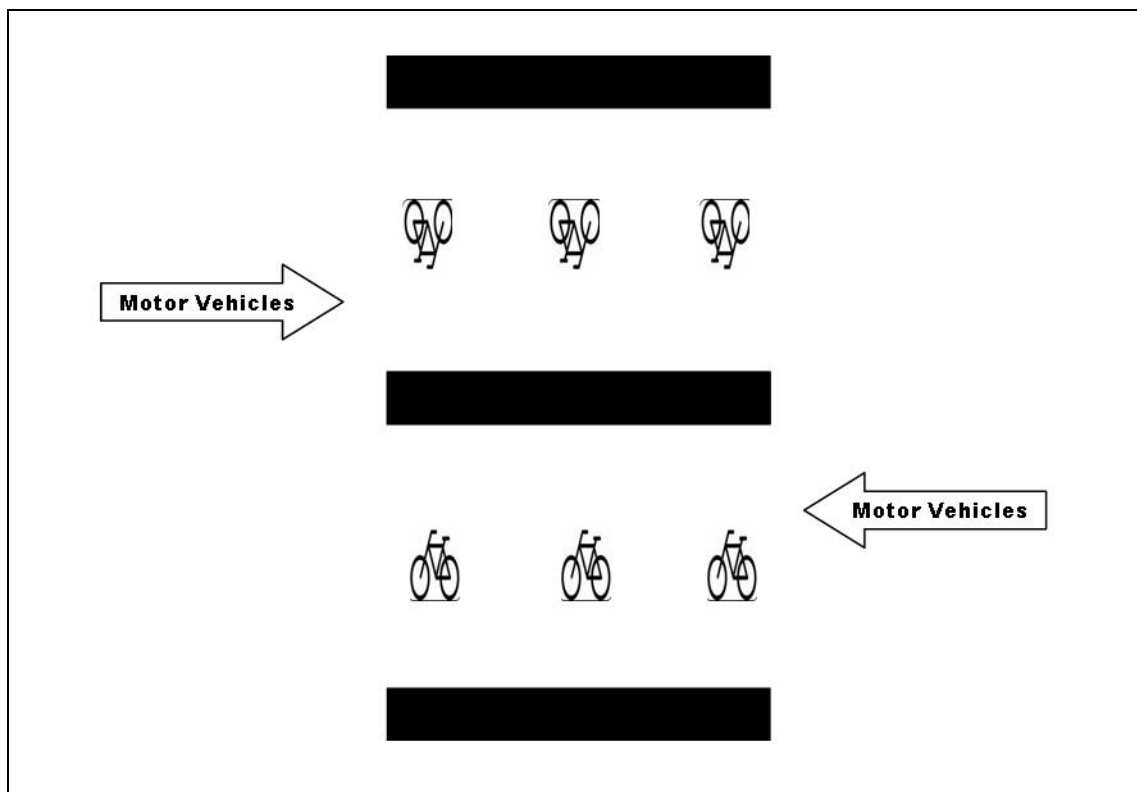


Figure 11: Suggested layout for shared unsignalised crossing

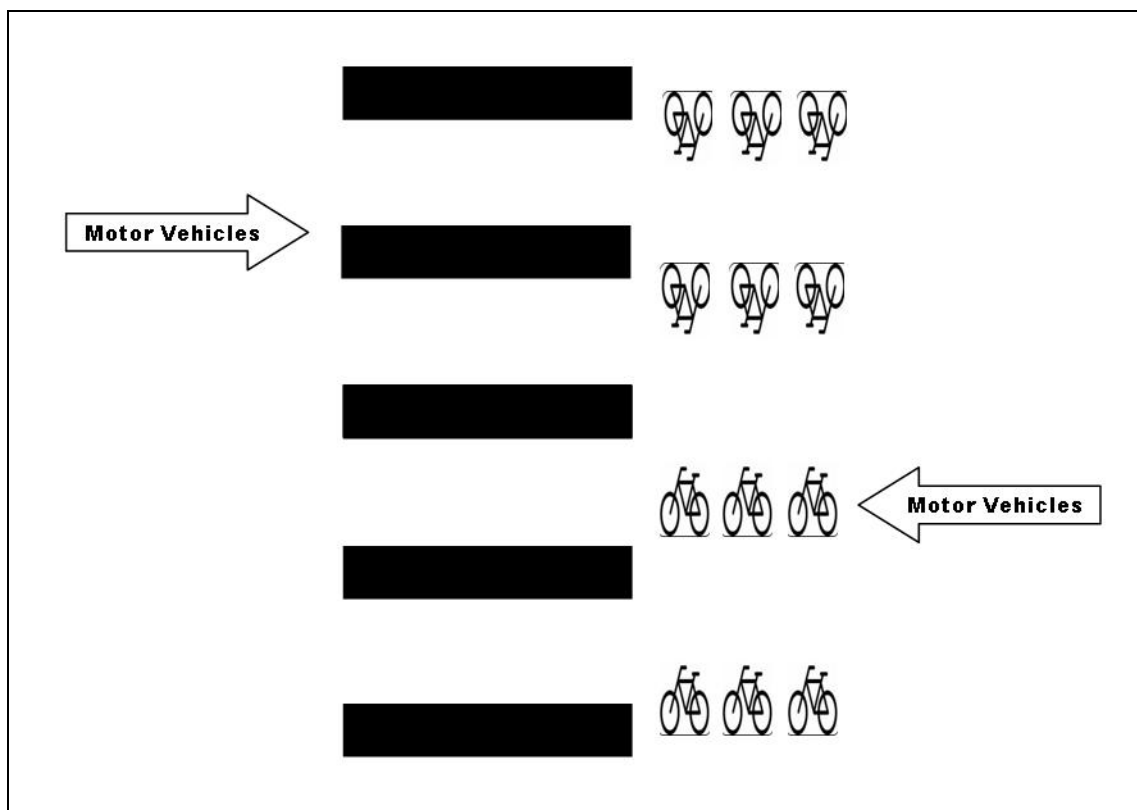


Figure 12: Suggested layout for segregated unsignalised crossing



None of the literature reviewed has quantified the volumes of pedestrians and cyclists using a crossing that determine if it should be a shared or segregated facility. Determination of this may need to be made on a site-by-site basis.

Approaches from the carriageway should be provided allowing cyclists using the traffic lane or cycle lanes to move behind the kerb before crossing. Warning signs for motorists should differentiate such a crossing type from the usual pedestrian crossing so that they are aware they must also check for and give way to cyclists.

Trials should first be undertaken. It is important that trialled crossing locations are properly surveyed to gain information on use (by both pedestrians and cyclists) before installation, immediately after installation and some time (about three months) after installation (to determine the occurrence of any novelty effects). Conflict studies should be held in conjunction with the surveys to assess the effects of the crossings on pedestrians' and cyclists' safety.

5.2 Signalised mid-block crossings

Signalised mid-block crossings, such as toucans, have already been proven to be safe for both pedestrians and cyclists; this in itself suggests that a rule change could be introduced to allow cyclists to ride over all signalised pedestrian mid-block crossings.

However, as is detailed in the following section, it is suggested that a rule change should not be introduced to allow cyclists to ride across signalised intersection crossings. Given this, it should be considered whether or not road rules can be written to clearly distinguish between mid-block and intersection crossings and whether or not the public can discern this difference. Rewriting the road rules should be a straight-forward task but this may not be easily adopted into general public practice. Allowing cyclists to ride across all signalised mid-block crossings but not signalised intersection crossings may be counterproductive, as cyclists may become more likely to ride across signalised intersection crossings.

A relatively simple remedy for this would be to equip all signalised mid-block crossings with cycle lanterns. Cycle lanterns that are separate to pedestrian lanterns have the advantage of allowing cyclists longer green times as they can cross the road faster (i.e. they require less clearance time). If cyclists and pedestrians are detected separately, a significant advantage would be that the crossing could return faster to the road phase when only cyclists cross, as their crossing time is much shorter than pedestrian crossing time.

A cheaper alternative is to change the aspect masks on existing pedestrian crossing lanterns so that they display both pedestrian and cycle symbols; an example of this is shown in **Error! Reference source not found.**





Figure 13: Combination pedestrian and cycle lantern, Bielefeld, Germany

5.3 Signalised intersection crossings

Many signalised intersection crossings are not safe for pedestrians due to filter turning of vehicles. Without introducing measures to address this it is not recommended that cyclists be allowed to ride on signalised intersection crossings.

It should theoretically be safe to allow cyclists to ride across signalised intersection crossings that do not allow filter turning, however it would be very difficult to actually produce a legislation to this effect and ensure that cyclists could actually distinguish between those intersections they could ride across and those where they would legally dismount. Also, by introducing such a discrepancy it is possible that cyclists, upon experiencing the benefits of being allowed to ride across some crossings, would decide to illegally ride across crossings with filter turns and endanger themselves.

One way around these problems is to fit crossings to be used by cyclists with cycle signals, and then use phasing measures to prevent filter turns from occurring when the cycle crossing is operated. Due to the additional signal hardware, cyclists should be able to distinguish those types of crossings from 'traditional' parallel pedestrian crosswalks.

6 Conclusions

Many examples from Australia and New Zealand and the rest of the world have shown that pedestrians and cyclists can interact and share the same road crossing facilities safely and efficiently. The biggest risk to people cycling across pedestrian crossings is from motor vehicles. Zebra crossings and signalised crossings with filter turning at intersections are commonly unsafe for pedestrians.



It is not recommended that cyclists be allowed to ride on zebra crossings in all circumstances. Instead it is recommended that new crossing types be introduced, both for shared and segregated use. Judgement should be used when to provide shared or segregated facilities. These new crossings would be similar to zebra crossings but would have distinguishing markings and would always be on raised platforms.

It is recommended that cycling across signalised mid-block crossings should be made legal. It is recommended that measures such as new lantern masks be introduced, so that cyclists clearly differentiate between mid-block crossings (which they can use) and intersection crossings (which they can use only in certain locations).

It is recommended that actions be taken to make signalised intersection crossings safer for pedestrians by mitigating (or removing) filter turns. Until this is done, it is not recommended that cyclists be allowed to ride across signalised intersection crossings. However, this can be introduced on a case-by-case basis using specific traffic signal equipment for cyclists and suitable phasing logic.



7 List of Personal Communications

Divall, D., Cycling Officer, Aylesbury Vale District Council, UK. Email 29 September 2007

Lekander, T., Road Safety Analyst, Swedish Road Administration. Email, 7 November 2007

Living Streets Aotearoa, Discussion Forum, Digest 579. Email, 15 November 2007

Thomas, L., Executive Director, Living Streets Aotearoa. Email, 15 November 2007

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