My daughter has just turned 13 and cycling is her sport. She has been cycling for 18 months and has just been selected to represent Queensland in the National Road Championships.

She cycles six days per week sometimes twice a day. Don't be fooled by her age she is a better cyclist than most adults on the road. By better I mean fitter, faster and well educated in safety practices.

We have employed a "coach" who rides with her every time on the road. To date the only large group she has cycled with on the road is the cycle club when they have organised a group ride and this is only a handful of times. At this point we don't feel it safe that she rides with a group for various reasons.

My husband and I are scared for our daughter. She loves her sport and is so passionate about becoming a cyclist and cycling for Australia but we feel as though we are negligent parents because we let her ride on the road and we know this to be dangerous.

My brother in law was killed 18 months ago by a driver who thought it would be funny to give the cyclist a scare. The driver lost control of his vehicle, coming up on the inside grass verge. Forensic evidence showed that he missed hitting my sister by a few millimetres. My brother in law was thrown into the air and died instantly.

My daughter and her coach ride single file, stop at every red light, obey all the road rules and are courteous road users and yet they are screamed at, have had a number of near misses with buses, drivers have veered towards them, have stopped to abuse them and on one occasion a driver who veered towards them lost control of his vehicle, ended up crossing the centre line into oncoming traffic and ended up skidding to a stop on the opposite side of the road. Thankfully he and other road users were unharmed.

I was annoyed at her coach on this occasion because he didn't approach the driver of the vehicle. After a few minutes they continued on their way. Her coach says it is not worth the hassle. He is jaded because he has ridden for 30 years and these attitudes and driver practices are common. He says if you argue back with drivers it further ignites the arguments and issues between cyclists and drivers. There are a lot of cyclists who feel the same. They have been riding for years and won't speak up.

Over the last 18 months we have had a number of acquaintances knocked off their bikes by drivers, some hospitalised. One was a 13 year old girl. (Also a Queensland representative cyclist). The driver saw her father coming around a roundabout but didn't look for a second cyclist. Her bike was damaged and she ended up with six weeks of rehab.

We have had some weeks with incident after incident. At these times we worry endlessly about our daughter's choice of sport. The odds dictate that it will only be a matter of time before we receive a phone call to say she has been in an accident and is injured or worse still fatally injured or killed and all because she wants to pursue a sport.

Something must be done to educate drivers to change their attitudes. Please believe there are a lot of drivers out there who are enraged by the mere sight of a cyclist just because they are there.

Recently my daughter was cycling on a country back road. I was following her in my car about 500 metres back to ensure she was safe. It was around 6 am in the morning. A well dressed lady crossed the road in front of my daughter with her dog. There was no one else on the road, just the three of us. My daughter cycled past her. The lady saw me, smiled and turned back toward the cyclist, raised her arms and shook her fists and head at the cyclist. It was an instant negative reaction toward a cyclist who she perceived was impeding my progress along the road. This was a quiet, empty country road and yet I believe her attitude speaks volumes about the attitudes Queenslanders have towards cyclists.

I have included a document (abridged version) presented to the Australian Cycling Conference in 2012 which I would like you to consider. It concludes that cyclists are less likely to be overlooked if they merge with cars and enter roundabouts from where car drivers look for cars (the middle of the lane). It is a difficult situation to be in as a parent - I recommend to my daughter that she ride through a roundoubt in the centre of the lane because it is safer for her, yet in doing so she endangers her life further by enraging drivers.

I know there are a lot of issues wrapped within this problem but I urge you please to consider everything fully and then act. Act to protect those in their pursuit to live a full rich life and to be fitter and healthier including my daughter.

The media daily cites road accident/death statistics; that there are problems on Queensland roads. I believe the solution is simple educate Queenslanders through TV advertisements that they choose to live in Queensland for a reason, the outdoor sports, carefree lifestyle. Demonstrate Queenslanders being courteous drivers to fellow Queenslanders who go about their carefree lifestyle.

Legislate that cyslists have equal right to be on the road (single file) and that driver's must give them one metre of clear space. Educate driver's that it is their responsibility to slow to ensure the driver passes a cyclist safely (and that it may mean they have to slow and sometimes wait for an opportune moment to pass). Put in place hefty fines for drivers who break the rules and publicise the fact fully and often. Make it clear through education programs that the Queensland Government is protecting the lifestyle of Queenslanders, that this is what Queensland is about lifestyle and courtesy among Queenslanders. Drivers only need to act courteously and obey the one metre rule. They will only be disavantaged should they break the road rules.

My daughter wants to cycle and pursue her dream to cycle for Australia. Isn't this the Australian dream? There shouldn't be a backdrop in the dream of rude, arrogant and abusive Queenslanders waiving fists and screaming who threaten your life.

1. Introduction

Installing a roundabout typically improves road safety. By reducing speed and reducing the number and severity of conflict points, roundabouts tend to lessen the number and severity of crashes. However, if cyclists are considered separately, crash numbers and severity sometimes increase (Daniels et al 2008; FHWA 2000).

The proportion of crashes involving cyclists tends to be much higher at roundabouts than elsewhere. In Melbourne inner municipalities, during the five years 2005-2009, close to 50% of crashes at roundabouts involve cyclists, whereas less than 10% of all crashes involve cyclists. For all of Victoria during this period, 4% of all reported crashes involved cyclists. At roundabouts, however, 24% involved cyclists.

"Entering-circulating" is the most common crash type at roundabouts – where an entering vehicle crashes into a vehicle already circulating. This type accounts for 48% of all crashes, but 82% of crashes involving bicycles – typically, an entering car strikes a circulating cyclist.

Reflecting after a crash, it is not uncommon for the cyclist to report that they saw the driver look, and for the driver to state that they looked, but that "the cyclist came from nowhere" (Herslund & Jorgensen 2003). Such a scenario is described in the literature as a "looked but failed to see" crash. Such reporting suggests that there may be value in a study of the precise location where drivers look

Conflict point theory, which considers precise locations of vehicles as they move through intersections, is used as a tool to examine bicycle-car interactions at roundabouts.

This paper examines the question of "what causes entering drivers to drive into circulating cyclists?" through (1) a literature review; (2) a case study of all reported Victorian roundabout crashes (2005-2009) – the source of the figures quoted above; and (3) logical thinking about conflict points and "conflict paths".

2. Literature review

2.1 Roundabout designs

Roundabouts operate as a series of separate T-intersections (Austroads 2009 p.90), with the top of the T having just one-way flows. Two common categories of roundabouts are illustrated in figure 1.



Figure 1: Roundabouts designs. (Patterson 2010)

Radial designs with their right angle entries and exits are like a series of T-junctions whereas tangential designs are more like a series of Y junctions. Some people think of small local road roundabouts as radial because the roads approach at right angles. However, Australian design practice is to create tangential entries through reshaping of kerbs and splitter islands. .Fay Patterson (2010) presents a review of roundabout design practice from an Australian perspective. A major point of difference is that UK, Sweden, New Zealand and Australia favour tangential entries which keep speeds high to increase capacity, while Germany, France, Denmark and Netherlands favour radial entries for greater safety - with greater deflections to slow vehicles and angles closer to 90° to improve visibility. German roundabout design rules prohibit cyclists on the dangerous outside edge of circulating areas. Schnull et al (1993) found that bicycle lanes and tracks increase risk over no treatment. Similarly, a UK study by Allott and Lomax Ltd. (1991) showed that the outer 1.5m of a roundabout is dangerous for cyclists. Flared entries and wide circulating lanes are also identified as hazards for cyclists. Hyden & Varhelyi (Sweden, 2000) encourage small singlelane roundabouts, with cyclists merging with cars into a single traffic stream well before roundabout entries.

Patterson (2010) concludes that Austroads and VicRoads recommendations for adding bicycle lanes to roundabouts appear to conflict with published safety research.

2.2 Cyclist behaviour

Video research conducted at roundabouts has shown that a large proportion of cyclists ride on the outside edge of the circulating lane and that the outside edge is dangerous.

(Arnold et al 2010 (California); Hyden & Varhelyi 2000 (Sweden); Sakshaug et al 2010 (Sweden))

In order to encourage cyclists to control the lane, all three articles suggest terminating bicycle lanes well before roundabouts. Arnold et al (2010) suggest installing "Cyclists Allowed Full Use of Lane" signs on roundabout approaches.

2.3 Crash analyses and crash types

Elvik and Vaa (2004) reviewed 34 studies from Northern Europe, Australia and the US about the effect on crashes of converting an intersection into a roundabout. Roundabouts reduced injury crashes by 10 to 40%. The reduction in serious injury crashes was generally greater than for less serious injury crashes. For cyclists, however, roundabouts did not have the same crash reduction effect. (Campbell et al 2006; Herslund & Jørgensen 2003; Jørgensen & Jørgensen 1994, Schoon & van Minnen 1993). After researching 91 Belgium roundabouts, Daniels et al (2008) concluded that installation of a roundabout increased cyclist injuries by 27% and serious or fatal bicycle crashes by 41%. Most researchers agree that: (1) official statistics under-represent actual cyclist crash numbers; (2) crashes involving cyclists are higher at roundabouts than elsewhere; and (3) entering drivers failing to give way to circulating cyclists is the most common crash type involving cyclists.

Swedish researchers (SNRTRI, 2000) report that changing roundabout geometry to reduce speeds can reduce cyclist crash numbers and severity.

2.4 Applying conflict point theory to roundabouts with circulating bicycles

While many researchers identify the outside edge of roundabouts as hazardous, the author was unable to find anything written specifically about conflict point theory as applied to the two traffic streams created by bicycles riding on the outer edge of circulating lanes.

2.5 "Looked but failed to see" phenomenon"

Looked-but-failed-to-see (LBFTS) crashes occur when a driver looks in the general direction of an oncoming hazard but does not notice it or give way.

These commonly occur when pulling out into a priority roadway, before switching lanes, or overtaking another vehicle (White & Caird 2010), and commonly involve two-wheeled vehicles (Koustanaïa et al 2007).



Figure 2: Bicycle-car collisions, by type (at a signcontrolled T-intersection). Reversed for clarity to left-side drivers.

Figure 2 illustrates long term European video research examining turning drivers crossing a two-way cycle path prior to an intersection. The highest count is (D), with 27 collisions between left-turning drivers and cyclists from the left. This compares to a count of zero (C) for collisions with cyclists from the right. Hidden cameras observed how left turning drivers scanned to the left much less frequently and later than those turning right. (Summala et al 1996). While the pictured example is not from roundabout research, it supports the hypothesis that drivers are checking the dominant traffic flow path for a gap to fill rather than scanning the whole intersection for all possible hazards. Applying this idea to roundabouts, if drivers are checking only the flow of cars for a gap, it is likely that they may overlook cyclists riding near the kerb.

After conducting in-depth interviews with cyclist and driver survivors of LBFTS crashes Herslund & Jørgensen (2003) confirmed that car drivers look in the direction of cyclists without perceiving them. Herslund & Jørgensen videoed cars and cyclists at roundabouts and noted that bicycles are often located in drivers' peripheral vision. They suggest that experienced drivers use fast search strategies such as concentrating on where cars usually are, so may be more prone to LBFTS collisions than less experienced drivers. Their gap selection research showed that while drivers allowed 4.6 seconds (mean, standard deviation 0.16) for cars, gaps for bicycles were only 3.3 seconds, with 12% entering with gaps of less than 2 seconds, suggesting that some drivers may be failing to see cyclists altogether. They conclude that cyclists are less likely to be overlooked if they merge with cars and enter roundabouts from where car drivers search for cars.



Proposed idea: