Cyclists at Roundabouts

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1 Introduction

Roundabouts have become one of the favourite forms of intersection controls in recent years. Reduced travel time delay for motorists and safety benefits are advantages over other forms of intersection control. Research has started on the impacts on cyclists of different roundabout designs. This paper reports on the research progress so far.

2 Background

Various past researches into roundabout safety have not differentiated between different types of roundabouts. Evidence exists, however, that single and multi-lane roundabouts have different safety implications for cyclists.

In Land Transport Safety Authority (LTSA, 1995), it is stated that on average, a 29% reduction of reported crashes for cyclists occurred when the intersection control was changed to roundabout. This analysis is based on the LTSA Crash Investigation Monitoring System, which comprised 55 roundabouts at that time. This suggests that a change to roundabout control is to be supported from a cycle-safety point of view.

In contrast to that, many cyclists believe that roundabouts are best avoided. This is confirmed in Transfund (2000). Cyclists account for 6% of all reported crashes at roundabouts (i.e. injury and non-injury crashes), compared to only 1% at traffic signals.

Since it is known that cyclists have a much higher under-reporting rate for non-injury crashes than motorists, it may be more meaningful to look at injury data only (Wilke and Koorey, 2001). LTSA data for the period 1996-2000 shows that out of 916 injury crashes at roundabouts, 243 involved a cyclist, i.e. **26%!** This compares with cycle injury crashes at traffic signals (223/3585 = 6%) and priority controlled intersections (1167/9116 = 13%).

All these data should be viewed in their context. For example, sites with a known crash history are more likely to be included in the LTSA monitoring systems than 'average' sites. On the other hand, the opinion has been put forward that the cycle injury proportion in roundabout crashes is so high because roundabouts are so safe for motorists that these have only few injury crashes. In other words, roundabouts are not unsafe for cyclists, they are just not as safe for them as for motorists.

3 Methodology

3.1 Data Sources

Four sets of roundabout data sources have been combined and updated. In total, the list comprises some 300 roundabouts throughout the country:

1. The LTSA monitoring system now comprises some 98 roundabouts. The commissioning dates of these roundabouts are known, and AADT[1] data are generally available on an approach-by-approach basis.
2. LTSA has a database of intersections where the action of installing a roundabout has been identified as a remedial measure. Some 78 of the intersections have been converted to roundabout control, with approach AADT data and implementation dates generally known.
3. Transfund has published a research report on accident prediction models, based on a methodology developed by Dr. Shane Turner. Some 50 roundabouts[2] are included in the

[1] Annual Average Daily Traffic, i.e. an average traffic demand.

analysis, based on movement count data at different time periods. As quite a few of these roundabouts are situated in Christchurch, movement numbers of cyclists are also known.

4. A survey of 113 roundabouts has been undertaken by LTSA (2000), researching features such as visibility, deflection, and number of approach lanes.

3.2 Roundabout Categories

For the purpose of this study, roundabouts with only one entry lane on all approaches, only one exit lane on all departures, and only one circulating lane over all entries are classed as **Single–Lane** roundabouts. Where two approach lanes exist, and the kerbside lane is marked with a 'left turn only' arrow, this is still considered to be a single lane roundabout.

When any exit, or any part of the circulating lanes are made up of more than one lane, or any approach with two lanes has the nearside lane not marked with a left turn only arrow, the roundabout is classed as **Multi–Lane**.

3.3 Work already undertaken

As a first step, the roundabouts had to be categorised. The database contains 168 and 101 single-lane and multi-lane roundabouts, respectively, and some 30 roundabouts have yet to be classified.

The crash records for the 300 sites have been obtained from the LTSA database for the 1991 to 2000 period.

3.4 Work still to be done

The roundabouts can now be analysed for their safety performance in the two roundabout categories by matching the crash records with the site. One analysis with all sites can be undertaken without taking traffic flows into account (i.e. an analysis not based on exposure). In addition, the influence of visibility and deflection can be tested, using data sets from (4) above. Car exposure-based data could be derived using data sets (1), (2) and (3), since traffic volumes are known. It may not be possible to derive meaningful cycle exposure data, since the number of roundabouts with known cycle volumes is very small.

A literature review also forms part of the study. In particular, it will be interesting to see how well overseas design guidelines correspond to the conclusions to be drawn from this research. Recommendations for a more cycle-friendly roundabout design will also be derived from this study.

3.5 Hypotheses

The author puts two hypotheses forward:

- Double lane roundabouts have a safety performance for cyclists that is far less favourable compared to single lane roundabouts.
- Contrary to design guidelines, the safety performance of (urban) roundabouts is better when intervisibility (i.e. the sight triangle concept, where approaching drivers observe other drivers on the immediate approach to the right) is restricted.

The first hypothesis is based on anecdotal evidence by cyclists, and supported by some design guides. The second hypothesis can be explained by the fact that when intervisibility is reduced, approaching drivers will have to slow down in order to be able to give way to traffic entering from the right. With reduced speeds, stopping distances are reduced when a driver has made a mistake. If a crash still occurs, lower speeds result in a lower severity.

4 Results

Results will be published in due course in the appropriate engineering publications. The newsletter of the Transportation Group (called 'Roundabout'), Transit, and Transfund publications are all suitable mediums for the dissemination of the information. In addition, the results will be offered to the cycling working party, which is currently being formed under the auspices of Transit.

[2] The Transfund research report contains 55 roundabouts, but some intersections have since changed to traffic signal control.

5 Conclusions

The author believes that the research will enable to judge more accurately the impact of different types of roundabouts on the safety of cyclists, but also on other road users. It is hoped that definite recommendations can be made with regards to safer roundabout design. As a result, road-controlling authorities may have to apply more stringent checks before commissioning new multi-lane roundabouts. It is also possible that current design standards may have to be changed.

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