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Cycling Safety Issues at Local Roundabouts and Proposed Solutions

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Cycling Safety Issues at Local Roundabouts

In the past year, a number of local roundabouts have been widened into two- or multi-lane roundabouts and have seen the addition of painted cycle lanes, directly adjacent to the road, without any form of separation (“adjacent cycle lanes''). Examples are the roundabouts at Triq Buqana between Mosta and Mdina, Triq tal-Balal between San Ġwann and Naxxar, and Triq l-Mdina in Żebbuġ. Figure 1a shows the typical design that is being implemented at local roundabouts, with cycle lanes in green. As can be seen from the plan, there is no separation between the cycle lane and the carriageway. While in the plan for such a roundabout there is indication of right of way on the approaching roads, in real life (as can be seen from the example of tal-Balal; Figure 1b) there are no road markings at all indicating who should give way, creating a confusing and dangerous situation for both cyclists and car drivers.

Figure 1a: Example of adjacent cycle lanes on local roundabout, proposed plan for Buqana roundabout.

Figure 1b. Photo of tal-Balal roundabout, where adjacent cycle lanes provide no separation from the carriageway, nor is there any indication of right of way.

The cycling safety of roundabouts is highly dependent on their design. Two-lane and multi-lane roundabouts increase the risk for cyclists when compared to single lane roundabouts (Reynolds et al., 2009). A single-lane roundabout with four side roads presents four conflict points: physical locations where vehicles cross paths (see figure 2a). In a two-lane roundabout, the number of conflict points rises to 16, due to the added complexity (see figure 2b). A roundabout with an adjacent cycle lane effectively adds another lane to the roundabout, thus transforming it into a two-lane roundabout, exponentially increasing the potential points of conflict (Cumming, 2011).

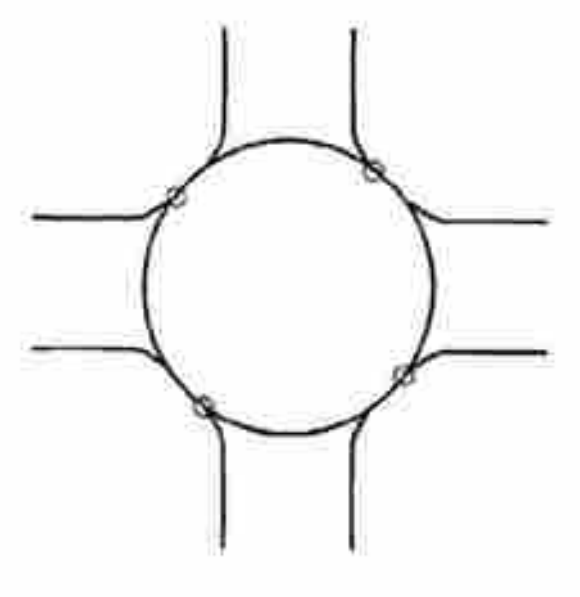

Figure 2a: A single-lane roundabout has four conflict points, where vehicle paths cross (Cumming, 2011).

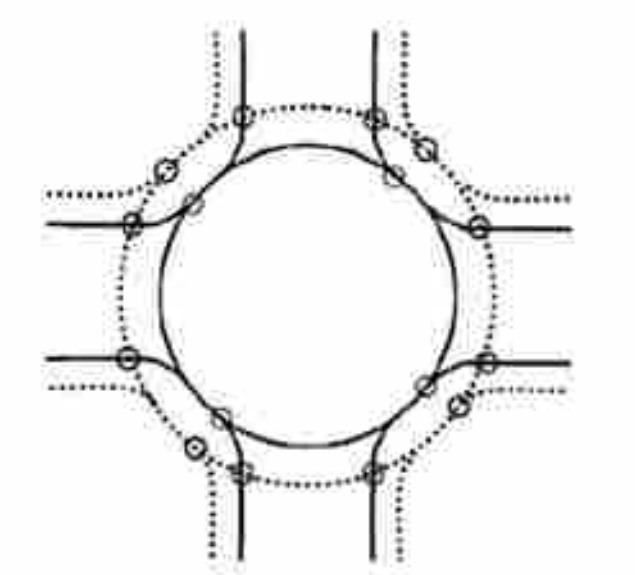

Figure 2b: A two-lane roundabout, with the second vehicle path indicated in dotted lines, creates 16 conflict points (Cumming, 2011).

In a review study of cycling safety of roundabout designs, Reynolds et al. (2009) found that roundabouts with adjacent cycle lanes provide the least reduction in injury rates (in a Dutch study; Schoon and van Minnen, 1994) and pose a significantly higher risk for cyclists (in a Belgian study; Daniels et al., 2009), when comparing to roundabouts with separated cycling tracks, and even when compared to a situation with no cycling infrastructure, with cyclists in mixed traffic (on single-lane roundabouts).

Roundabouts with adjacent cycle lanes present a huge risk of conflicts between vehicles exiting the roundabout and cyclists circulating around the roundabout (Daniels & Wets, 2005). This is especially the case with larger vehicles, such as in trucks' blind spots, as shown in Figure 3a. The adjacent cycle lane adds another lane to the roundabout, but cyclists cannot follow the basic roundabout rule (where a road user chooses lane depending on the point of exit). Forcing cyclists to circulate the roundabout on the outside perimeter increases the chance of conflict, especially when a cyclist needs to take the second or third exit of a roundabout, as the cyclist will end up in the path of vehicles exiting the roundabout. Motorists exiting the roundabout tend to cut in front of cyclists, which is far riskier on adjacent cycle lanes on multi-lane roundabouts, which force cyclists to remain close to the edge (Presto, 2014).

The addition of slip lanes to a roundabout is in itself potentially a good solution, as it adds capacity without increasing points of conflict on the roundabout (Cumming, 2011). However, it can create difficulties for cyclists, as can be seen in Figure 3b, where in order to join the roundabout, a cyclist must leave the cycle lane (as it is veering left alongside the slip lane) and join the main carriageway instead. Motorists entering the roundabout also do not give way to cyclists on the edge of the roundabout, often blocking the cycle lane completely as motorists are more focused on the centre of the roundabout (Presto, 2014), as shown in Figure 3c.

Figure 3a (left), 3b (middle) and 3c (right): Potential conflicts on roundabout with adjacent cycle lanes (drawn by author, Matthew Farrugia, based on Buqana roundabout plans).

For the reasons presented above, German roundabout design rules prohibit cyclists on the dangerous outside edge of circulating areas (Cumming, 2011). The Dutch standards for cycling infrastructure discourage cycle lanes on the roundabout (CROW, 2016: 147) and recommend segregated cycle paths or grade separated cycle paths. After reviewing the literature, transport engineer and road safety expert B. Cumming from Victoria, Australia recommends that “National and state road authorities are urged to review existing research about the dangers for bicycles in the outside edge of roundabout circulating areas and to update and reissue roundabout design guidelines” (Cumming, 2011).

Potential solutions to create safer roundabouts

The solution providing the highest degree of safety are roundabouts with segregated cycle paths, either physically separated with kerbs and green strips, or grade separated (e.g. where the cycle path flows under the road through an underpass). Roundabouts with segregated cycle paths are safer than roundabouts with mixed traffic or roundabouts with adjacent cycle lanes (Daniels & Wets, 2005; Reynolds et al., 2009). Instead of placing the cycle lane adjacent to the road on the roundabout, the space needed for the separated cycle path can be allocated further away from the road, separating the cycle path from the carriageway using elevated kerbs, green strips and splitter islands. It is important that when cyclists are approaching a crossing, adequate segregation and enough space is provided for a secure 90-degree turn in order for cyclist and car driver to be able to see each other before crossing is attempted. Furthermore, it is important that the right of way is clearly indicated. It is generally safer to give priority to vehicular traffic, so that the judgment of safe crossing lies with the cyclist (Daniels & Wets, 2005). This is especially recommended in cities and countries where cycling is not so common (so-called “starter cycling cities''), where drivers may not be expecting cyclists or do not find it logical to give way to cyclists (Presto, 2014). See Figure 4a and 4b for an example.

Even where there is limited space or budget available, there is scope to improve roundabout design to increase cycling safety, by installing raised outer kerbs (separating the cycle lane from the carriageway) and parallel splitter islands and traffic islands, and by indicating the preferred centre lane position of cyclists using markings (Cumming, 2011).

Measures to slow down approaching vehicles can improve safety, such as using speed tables before the roundabout, by narrowing the road or removing a lane, and by juxtaposing cycle crossings and pedestrian zebra crossings (Presto, 2014).

For single-lane roundabouts with low traffic volumes and speeds, a mixed traffic approach can be a solution. In such a case, it is important that cyclists take the centre lane when approaching the roundabout, so that they behave in the same way as other vehicles and take position where they are visible to other road users. If there is a cycle lane on the road leading up to the roundabout, it is important that cyclists are advised to merge with the main carriageway before arriving at the roundabout. Signs and symbols can be used to inform cyclists and drivers about the merge. If a slip lane is used in the roundabout design, this lane should start after cyclists and drivers have merged (Cumming, 2011).

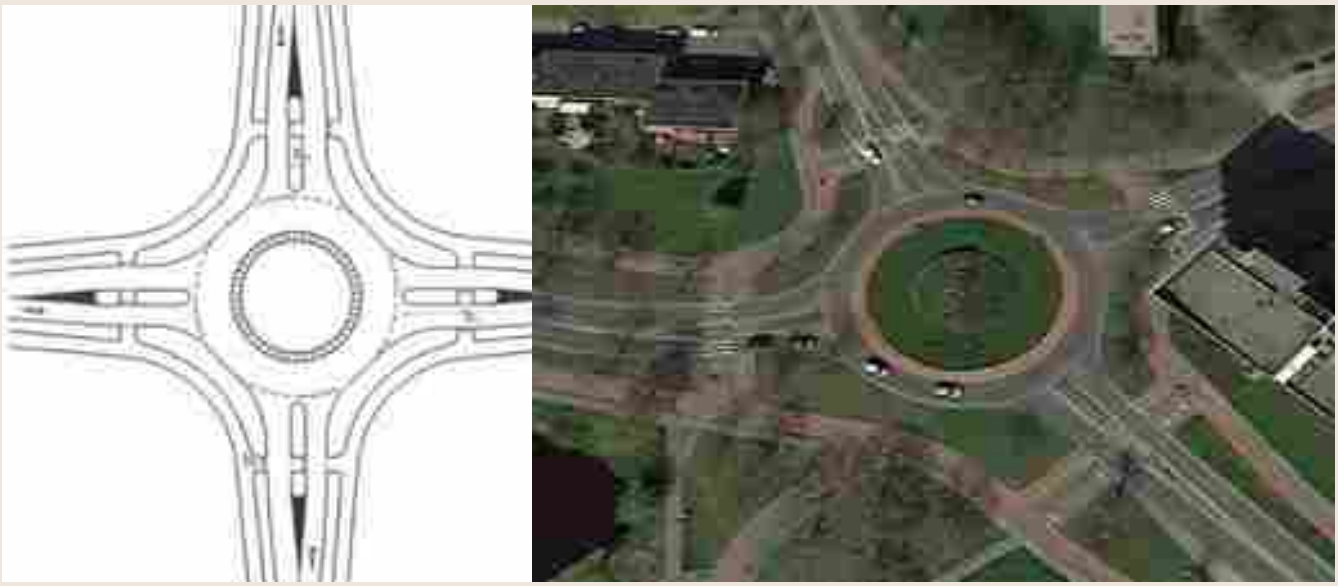

Figure 4a (left) and 4b (right): Schematic design from CROW Bicycle Design Manual and a real-life example of a roundabout with segregated cycle path with no right of way for cyclists in a right-driving scenario (CROW, 2016).

Conclusion

It is clear from the literature and from design standards from other countries that adjacent cycle lanes are not a safe solution for cyclists to navigate roundabouts. Possible solutions include the creation of segregated cycle paths, either physically separated by kerbs or green strips, or grade separated. A solution for roundabouts with low vehicle speeds and volumes is a mixed traffic approach, where cyclists take centre lanes when approaching the roundabout and circulate like other vehicles, aided by signs and markings.

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