



Cycling roads and one-way streets with contra-flow cycling

Compact accident research

Unfallforschung
der Versicherer



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Background

Background

Cycling roads and one-way streets where cycling against the flow of traffic is permitted are now part of the standard repertoire of cycling traffic planners in Germany. These two infrastructure elements were introduced in Germany in 1997 by an amendment of the German Road Traffic Regulations (StVO). However, they differ in terms of their intended purpose and the information available about their safety. The purpose of permitting contra-flow cycling on one-way streets is, above all, to increase the use of minor roads by cyclists and minimize the diversions they have to take. The safety of one-way streets with contra-flow cycling has been studied in depth, and their essential safety has been demonstrated. Cycling roads, on the other hand, are intended primarily to attract cyclists and give them priority on roads that are particularly suitable for cycling. These roads should be introduced, above all, where there is a high density of cyclists. Whereas cycling roads spread fairly slowly in the early years following their introduction, in recent years they have spread more quickly. In contrast to one-way streets with contra-flow cycling, the safety of dedicated cycling roads has not yet been studied extensively.

Aim

The planning offices Planerbüro Südstadt and VIA were commissioned by the UDV to carry out a research project to obtain new findings on the spread, areas of application and road safety of these two infrastructure elements. Since there are established findings on the road safety of contra-flow cycling on one-way streets, the main focus of the study was cycling roads. The analysis of one-way streets was restricted to streets with contra-flow cycling that had a conspicuously high incidence of accidents.

Methodology

The studies of the two infrastructure elements were carried out separately, although they both followed the same pattern. Following an analysis of the literature, a Germany-wide online survey was conducted of 359 municipalities of different sizes in order to gain an overview of the spread, layout, design and operation of these two elements in practice at the local level. Concrete examples were requested in order to obtain sections of road that could be used in the study. The accident data of the years 2008 to 2012 for the 177 cycling roads and 31 one-way streets with contra-flow cycling that were mentioned by the municipalities as being problematic was analyzed macroscopically [1] and microscopically [2] and related to the infrastructure in place locally. Based on the results of the survey of municipalities and the accident analysis, 26 locations were selected for behavioral observation, 21 of which were on cycling roads and five on one-way streets with contra-flow cycling. At 21 intersections and on five sections of road, data on traffic and behavior (traffic volumes, speeds, interactions and conflicts) was obtained and analyzed. In addition, cyclists, drivers and pedestrians (a total of 452 road users) were surveyed locally about their knowledge of the rules on cycling roads and how safe they felt. Finally, recommendations for the safe

design of cycling roads and one-way streets with contra-flow cycling were obtained on the basis of the findings.

Findings for cycling roads

In accordance with the General Administrative Regulations on the Road Traffic Regulations (VwV-StVO), cycling roads can be established where cycling is the predominant form of transport or is expected to be soon. The volume of motor traffic on cycling roads must be low. Cycling roads are designated by means of traffic signs 244.1 and 244.2 of the StVO (Figure 1). Any other traffic than cycling traffic may only exceptionally be permitted provided relevant additional signs are in place (permitting residents' vehicles only, for example). The speed limit on cycling roads is 30 km/h. Cycling traffic on cycling roads must not be put in danger or hindered by other kinds of traffic. Motor vehicles must reduce their speed further wherever necessary. It is permitted for cyclists to cycle side by side. The stipulations regarding right of way at the intersections of cycling roads in the guidelines on the design of roads in built-up areas (RASt 2006) and in the recommendations for cycling facilities (ERA 2010) are different. Whereas RAST 2006 stipulates that cycling roads should have right of way over other local access roads, in ERA 2010 it is recommended that this should depend on the local situation.

The studies of road safety on cycling roads examined in the analysis of the literature are based on very small samples and do not allow generally applicable conclusions to be drawn. However, it became apparent that the cycling roads previously studied did not have a conspicuously high number of conflicts or accidents.

Findings for cycling roads



Figure 1: Cycling roads are designated by means of traffic signs 244.1 and 244.2 of the StVO

According to the survey of municipalities, cycling roads have been implemented throughout Germany, and the municipalities' assessment of their safety is overwhelmingly positive. Although, according to VwV-StVO, motor traffic is only permitted on cycling roads in exceptional cases, motor vehicles are permitted to use virtually all

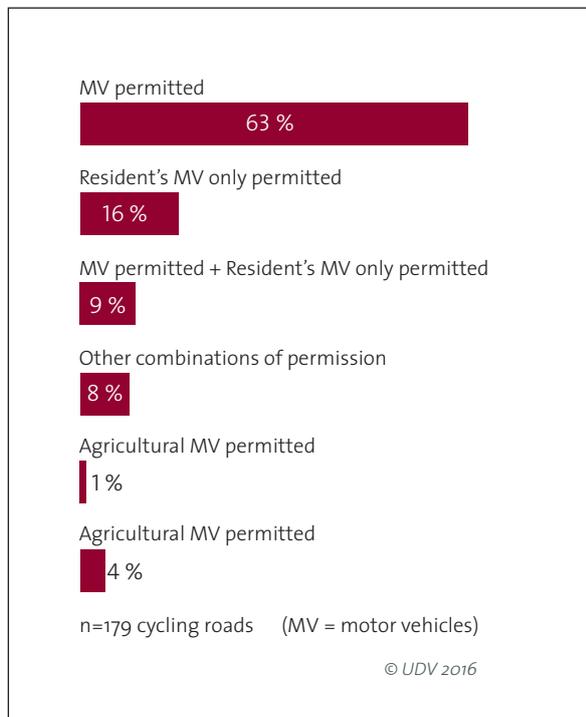


Figure 2: Other vehicles permitted on cycling roads

the cycling roads studied (96 percent), and in almost two-thirds of them this is not limited to residents only (Figure 2). Moreover, the cycling roads studied were neither uniformly designed nor did they have uniform arrangements governing right of way (Figure 3).

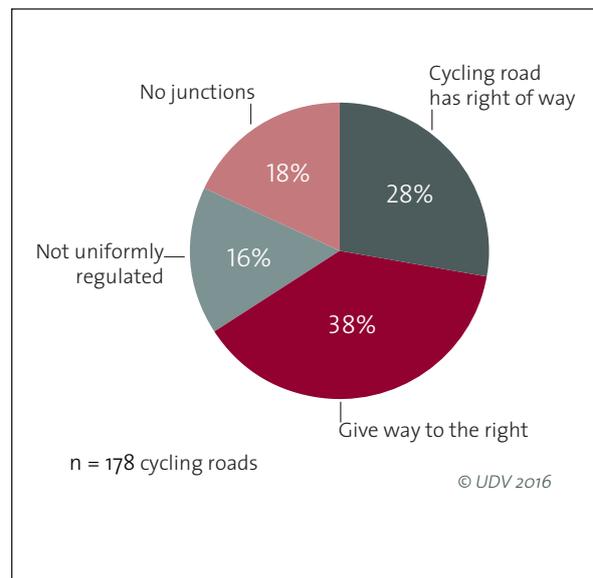


Figure 3: Arrangements governing right of way on the cycling roads studied

The accident analysis showed that cycling roads are essentially relatively safe. An average of only three to four accidents involving cyclists and injury occurred per cycling road in the five-year period studied. Moreover, only around one in three of these accidents had an evident connection with the cycling road. Around half of the accidents happened on an open section of road and half at an intersection. Despite the low total number of accidents, they followed a typical pattern. 80 percent of the accidents involving cyclists at intersections were “turning-into/crossing” accidents (where vehicles failed to give way and turned into or crossed the road). 56 percent of the accidents on the open sections of road occurred in connection with the parking of motor vehicles (Figure 4), and 19 percent occurred during overtaking with the in-

Findings for cycling roads

volvement of motor vehicles (Figure 5). The most common other party in an accident involving a cyclist was a car (in 76 percent of cases). In three of every four accidents, the driver of the car was the main cause of the accident.

99 percent of the roughly 6,500 interactions between road users on cycling roads were found to be free of conflict in the behavioral observation section of the study. Most of the 80 conflicts identified concerned right of way (76 percent).

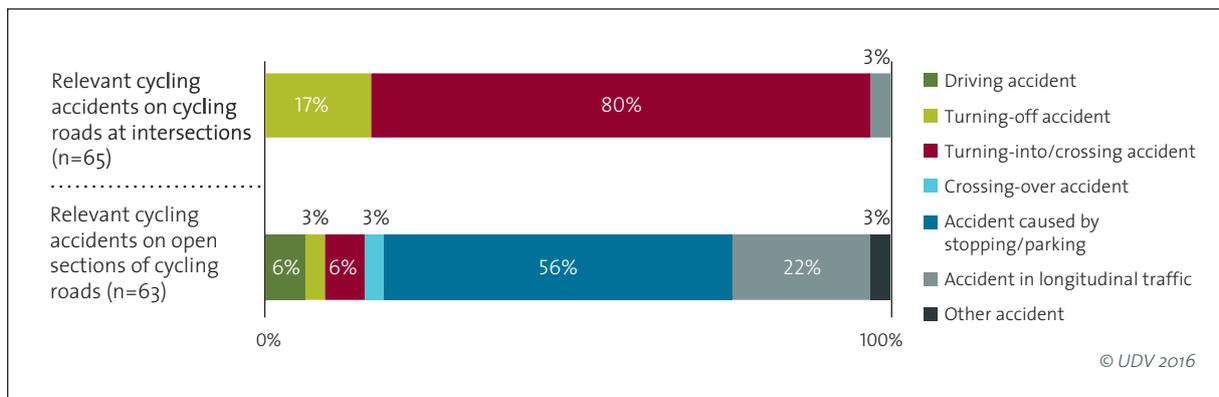


Figure 4: Accident types of relevant cycling accidents involving injury at cycling road intersections and on open sections of cycling road (2008-2012)

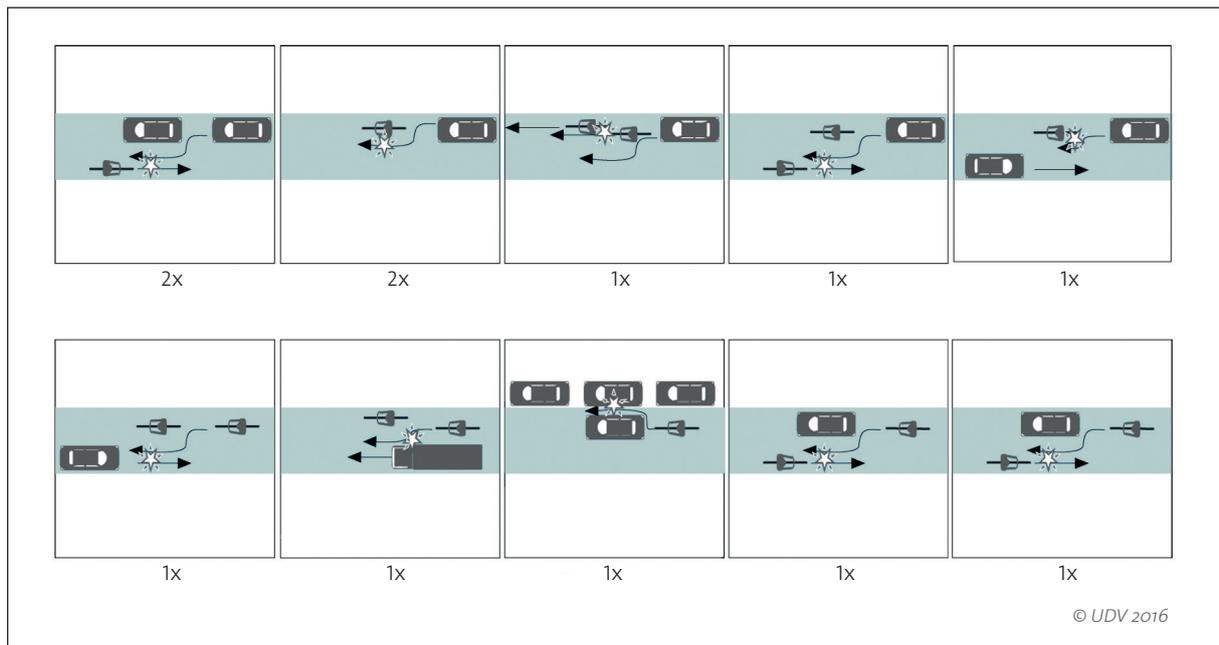


Figure 5: Overtaking accidents on cycling roads with the involvement of motor vehicles (12 of 63 accidents on open sections)

Findings for cycling roads

Motor vehicles did not always keep to the speed limit of 30 km/h on the observed cycling roads ($V_{85} = 36$ km/h on average). Excessive speeds were found more often on wide cycling roads where there was also a low proportion of cycling traffic ($V_{85} = 38$ km/h). More than one in three motor vehicles were driving faster than 35 km/h (34 percent), and around one in 12 were driving faster than 40 km/h (8 percent) on wide cycling roads.

The results of the survey of road users showed large gaps in the knowledge of all road users with regard to the rules on cycling roads. Virtually no differences were found in this respect between cyclists, pedestrians and drivers (Figure 6). For example, three-quarters of those

surveyed did not know that other vehicles may only use cycling roads when it is expressly permitted by means of an additional road sign. Only around half of those surveyed knew that cyclists on cycling roads are allowed to cycle side by side or that cyclists do not always have right of way at intersections on cycling roads. Around one in three road users did not know that cyclists also have to cycle on the right on cycling roads or that the speed limit is 30 km/h. In addition, the cycling roads observed were clearly not always recognized as such by all road users. For example, around one in four of the road users surveyed were not aware that they were on a cycling road when surveyed (in the case of drivers it was one in three).

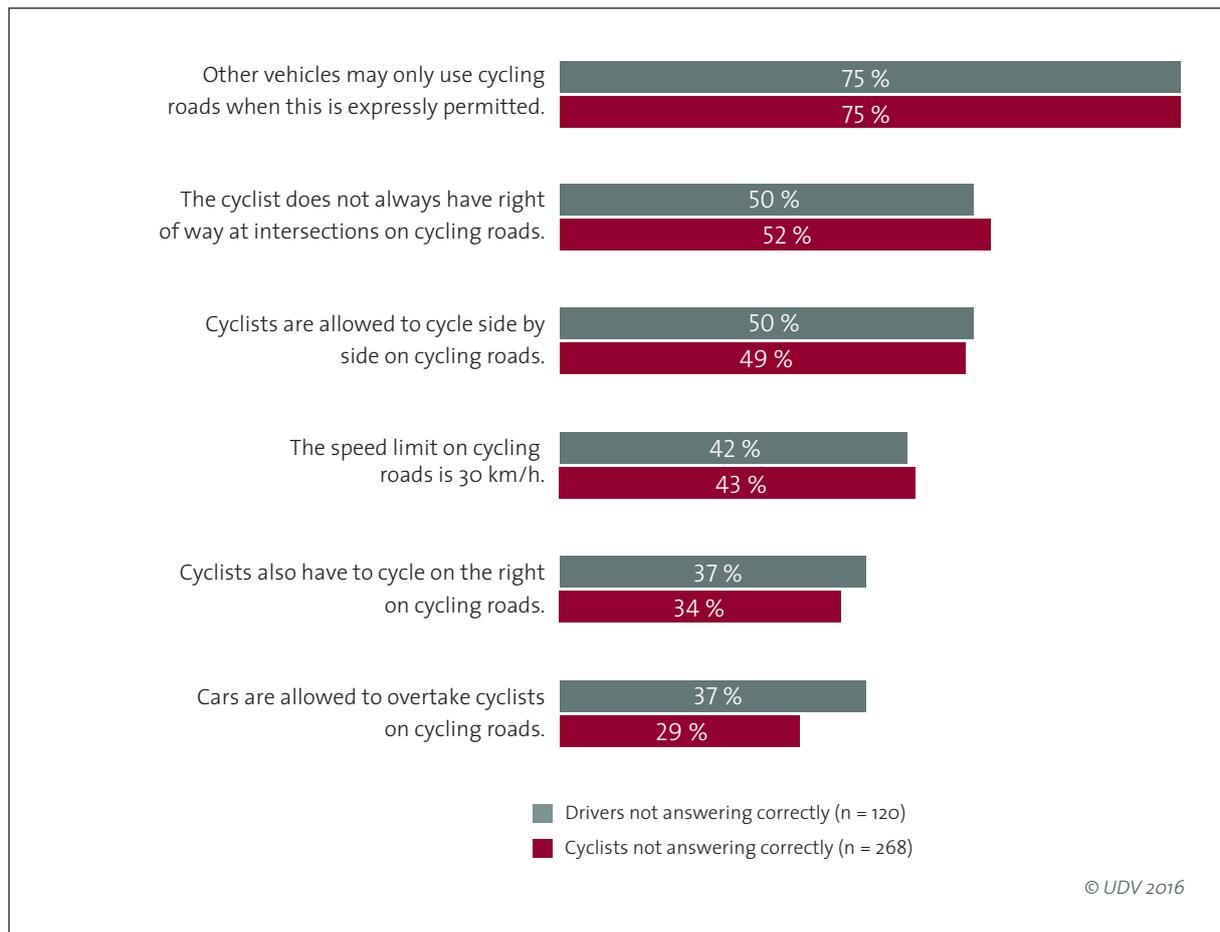


Figure 6: Considerable gaps in knowledge with regard to the rules for cycling roads

Recommendations for cycling roads

As stipulated in VwV-StVO and the relevant design guidelines, cycling roads come into consideration where cycling is the most common form of transport or is expected to be before long. The volume of motor traffic on cycling roads must be low according to VwV-StVO, and motor traffic may only be permitted in exceptional cases. A cycling road should therefore only be created provided these criteria are met. A certain absolutely necessary but significantly lower level of motor traffic than usual (e.g. residents only) can be tolerated provided the conditions specified below are met.

Cycling roads are essentially safe because accidents are relatively rare. Nevertheless the great majority of cycling accidents on cycling roads involve motor vehicles, despite the fact that they are only supposed to be permitted on cycling roads in exceptional cases. However, during the study it was found that motor vehicles are permitted to use virtually all the cycling roads studied, and in almost two-thirds of them this is not limited to residents only. It is recommended that there should be a more restrictive approach to allowing motor vehicles to use these roads. That means that VwV-StVO must be applied rigorously in this respect. Wherever possible, the unlimited permission for motor vehicles to use cycling roads should not be given. If it is absolutely necessary in order to provide access, it should be permitted for residents only. This also means that, before a cycling road is established, it must be examined whether there are suitable alternative routes available for the motor vehicles that are to be excluded. In addition, the ban on motor vehicles without permission entering or passing through cycling roads must be policed, and offending drivers must be penalized.

Although the research project did not investigate direct relationships between road width and accidents, recommendations for road widths of bicycle roads can be derived from the results of the investigations. For accidents on open sections of cycling roads, two causes of accidents are the most important: accidents in connection with the parking of motor vehicles and accidents occurring during overtaking with the involvement of motor vehicles. Accidents with parked motor vehicles occur primarily on narrow cycling roads. Accidents during overtaking were more likely to be found on wider cycling roads. Consequently, the width of the road plays an important role in road safety on cycling roads, particularly when motor vehicles are permitted. The suitable road design can be derived from the necessary clearance profiles of the RASt 2006. In order to ensure that two cyclists cycling side-by-side can pass two oncoming cyclists cycling side-by-side safely, the width of the cycling road consequently should be at least 4 m plus the required safety clearance from parked vehicles (0.75 m in the case of parallel parking). In this case, it is also possible for cars to overtake or pass oncoming single cyclists while maintaining the required safety clearance. To ensure that two cyclists cycling side-by-side can pass an oncoming car safely, a road width of at least 4.6 m plus the required safety clearance from parked vehicles is necessary.

Significantly wider roads are not to be recommended, since otherwise drivers would be tempted to drive at excessive speeds because the wider road offers them more scope to overtake. Greater road widths may be used only when motor vehicles are not permitted on the cycling road or overtaking is largely prevented by high volumes of cycling traffic.

In order to make the safety clearance from parked vehicles clear, a safety line can be painted on the road surface next to the parked vehicles (0.75 m in the case of parallel parking). In addition to the prescribed traffic signs, it can be useful to mark the pictogram "bicycle" or the traffic sign 244.1 - "cycling road" on the road, in order to clarify the road users once again that they are in a cycling road.

Findings for one-way streets with contra-flow cycling

In addition, wherever possible, a cycling road should have a uniform design along its entire length. That applies, above all, to the rules on right of way at intersections. Wherever possible, cycling traffic should have right of way at intersections, except at intersections with main roads, to ensure that the cycling road fulfills the intention of being an infrastructure element that gives cyclists priority. It must be clear in each case that traffic from side roads must give way by means of signs, humps, lowered curbs or narrowing of the roadway, for example.

If it is not possible for traffic-related or structural reasons, for example, to give a cycling road right of way at the overwhelming majority of its intersections, it is questionable whether it makes sense to create a cycling road in this case. The study revealed that there is not much difference between cycling roads and roads in 30 km/h zones in terms of the accidents that occur. The signs on cycling roads that were previously roads in 30 km/h zones and where the right-before-left rule is still applicable at intersections are therefore questionable, at least from the point of view of road safety, but also given that the intention of creating a cycling road is to prioritize cycling.

As the results of the project show, not only is compliance with the planning aspects mentioned above required, but police checks are also necessary to ensure compliance with the rules, and work has to be done to explain the rules applicable on cycling roads.

Findings for one-way streets with contra-flow cycling

In a study of the German Federal Highway Research Institute (BAST), it was found that opening one-way streets to contra-flow cycling has a positive impact on road safety on one-way streets (PGV/BIS 2001). Drivers drive more slowly on one-way streets when there are oncoming cyclists, whereas they generally accelerate when they are overtaking cyclists. It was also found that pedestrian safety is improved. Conflicts with cyclists cycling illegally on the pavement against the flow of traffic are avoided, because once the one-way street is open to contra-flow cycling, the cyclists generally cycle legally on the roadway.

Within the framework of the current UDV study, a Germany-wide survey of municipalities revealed that one-way streets with contra-flow cycling are very widespread throughout the country (Figure 7). 84 percent of the municipalities surveyed (260 of 311 municipalities) indicated that they had opened a total of 2,373 one-way streets to contra-flow cycling. Only 25 of these one-way streets with contra-flow cycling (1 percent) were rated problematic in terms of road safety by the municipalities.

Moreover, the accident analysis carried out for one-way streets with contra-flow cycling that were rated problematic indicated that only around one in three cycling accidents on these one-way streets involved cyclists cycling against the flow of traffic. In addition, the analysis of accidents in a study area in the center of Cologne used for comparison purposes confirmed that there are very few accidents involving cyclists cycling against the flow on one-way streets with contra-flow cycling. In a total of 200 one-way streets with contra-flow cycling in the center of Cologne, an average of around only 13 accidents a year occurred involving cyclists cycling against the flow of traffic.

Findings for one-way streets with contra-flow cycling



Figure 7: One-way streets with contra-flow cycling are very widespread

Recommendations for one-way streets with contra-flow cycling • Annotations

Where accidents involving contra-flow cyclists occurred at intersections, these were typically “turning-into/crossing” accidents (accidents in which vehicles failed to give way and turned into or crossed the road, which accounted for over 70 percent of the accidents involving contra-flow cyclists and injury). On sections of road without intersections, accidents involving pedestrians crossing the road occurred, above all, in shopping streets, where pedestrians more often tend to cross the road.

In the observations of behavior on five one-way streets with contra-flow cycling, very few conflicts with contra-flow cyclists were observed. There were 12 conflicts in 475 observed interactions, a conflict rate of around 2.5 percent. The conflicts occurred as a result of failures to give way (eight conflicts) or incorrect use of the roadway (four conflicts [3]).

Recommendations for one-way streets with contra-flow cycling

One-way streets with contra-flow cycling are essentially very safe. When contra-flow cycling is to be permitted on a one-way street, the relevant guidelines for one-way streets with contra-flow cycling in VwV-StVO and RASt 06 should be complied with. That means, above all, that there should be signs at intersections indicating that there is cycling traffic in both directions. In shopping streets where pedestrians frequently cross the road, the fact that contra-flow cycling is permitted should also be made clear to pedestrians (e.g. by means of pictograms and arrows on the road surface). At the corresponding crossing points, it must be ensured that pedestrians have an adequate view of any contra-flow cyclists. It may be necessary to make different arrangements for parking in order to make sure that contra-flow cyclists are within pedestrians’ field of vision.

Annotations

[1] 607 cycling accidents involving injury on cycling roads and 152 on one-way streets with contra-flow cycling

[2] 186 accidents involving cyclists and injury on 75 cycling roads and 54 accidents involving contra-flow cycling and injury on 20 one-way streets with contra-flow cycling

[3] Motor vehicle gets into oncoming traffic when turning off, motor vehicle performs an u-turn at an intersection or cyclist cycles on the sidewalk

Sources

ERA 2010 – Empfehlungen für Radverkehrsanlagen (recommendations for cycling facilities), 2010 issue. German Road and Transport Research Association (FGSV), Cologne.

PGV/BIS; Planungsgemeinschaft Verkehr, Hannover/ Büro für integrierte Stadt- und Verkehrsplanung, Bonn (2001): Verkehrssicherheit in Einbahnstraßen mit gegen gerichtetem Radverkehr (road safety in one-way streets with contra-flow cycling), Berichte der Bundesanstalt für Straßenwesen Heft V83; Bergisch Gladbach

RASt 2006 – Richtlinien für die Anlage von Stadtstraßen (guidelines on the design of roads in built-up areas), 2006 issue. German Road and Transport Research Association (FGSV), Cologne.

StVO (German road traffic regulations) of March 6, 2013 (BGBl. I page 367), amended by Article 2 of the regulation of September 15, 2015 (BGBl. I page 1573).

VwV-StVO – Allgemeine Verwaltungsvorschrift zur Straßenverkehrs-Ordnung (general administrative regulations for the road traffic regulations) of October 22, 1998, in the version of September 22, 2015.



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