
Diploma Thesis Summary

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Topic: Opportunities to address the needs of visually impaired people at zebra crossings
Zebra crossings – Appropriate crossing facilities for weak road users?

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Zebra crossings are a controversial element of German road transport in the public but also among professionals. Especially from vulnerable road users (e.g. children, the elderly and disabled) and their representatives there has been repeated criticism about zebra crossings being unsafe and unsuitable as a crossing aid. Safety concerns are also the reason of disagreement among experts, although this discussion is based on fairly abstract considerations about the correct separation and the adequacy of the broad set of rules and requirements for zebra crossings, set by the regulations federal guidelines.

This skepticism comes as a surprise considering the guidelines for pedestrian and vehicular traffic are clearly stated in German traffic regulations. The so called "Straßenverkehrsordnung" even has a separate paragraph devoted to zebra crossings, defining in subparagraph 1: "Vehicles other than railway vehicles have to give way to pedestrians and wheelchairs who recognizably want to use the zebra crossing. In those cases they are constrained to drive up at a moderate speed, and have to stop and wait if necessary." Therefore a high protective impact of zebra crossings are to be expected, in theory no less so than in the case of traffic lights.

However, this theoretical protective function does not properly translate to reality for various reasons. A evaluation of the development of the relevant guidelines in the Straßenverkehrsordnung in 1964 as well as relevant court decisions show that zebra crossings do in fact not relieve the pedestrian of the need to actively secure himself against vehicular traffic before and during the process of crossing. In general, pedestrians that enter a zebra crossing inattentive and without regard to the vehicular traffic are usually held liable for a substantial proportion of resulting accidents in court, despite their right of way.

This obligation of pedestrians to look after their own safety is comparable to those at a free road crossing outside of crossing facilities. But it is exactly this obligation that cannot be fulfilled by a significant proportion of vulnerable road users. As part of their personal safety, pedestrians have in particular to be able to detect and correctly gauge the situation of driving traffic, including possible influences of their surroundings. This requires a set of skills that children, disabled and the elderly for varying reasons may not fully possess, but most of all it relies on optical orientation. For example, children do not have the full visual potential to focus in depth, prohibiting them from estimating speeds and distances accurately; furthermore is the mere possibility to properly see in depth not a guarantee for that information to be correctly processed and used. The elderly on the other hand might often enough have lost the ability to make out the right distance and speed in the relevant timeframe,

making unaided road crossing a dangerous affair; the situation of visually handicapped and blind people is self-explanatory in this context.

Zebra crossings thus impose demands on their users which some pedestrians will be unable to fulfill and are therefore of limited functional use for these people. Nevertheless, the result of these considerations is not to waive the zebra crossing as an element in transport planning in the future. Instead, this work analyzes crossing facilities that are suited for the needs of vulnerable road users and considers their impact on normal pedestrians. An overview of the existing types and forms of crossing facilities shows that there is currently no crossing aid that could be used widely and can be considered equally safe and efficient for all everyone, due to the very inhomogeneous abilities and needs of pedestrians. On the contrary, the conclusion is that the increase in the security of the weak foot traffic (this is the priority for this group) leads to severe restrictions of the overall lightness of foot traffic. Scientific observations showed that these restrictions in turn prompted a significant part of the pedestrians to ignore the system, thus introducing new hazards to the road and reducing the desired safety benefits of crossing aids to absurdity. Conversely, pedestrian crossing facilities providing a high lightness frequently impose an unacceptable security problem on weak pedestrians, often resulting in mobility exclusion for these people.

The focus of further consideration was therefore on one hand how the safety of zebra crossings can be objectively and subjectively enhanced, and furthermore give a close examination of the possibilities for the development of an adapted crossing aid form, which is more suited to equally satisfy and integrate the different needs of the various pedestrian groups than the previously known types. The second aspect of this is based largely on the objective of the German Federal Ministry of Transport, Building and Urban Affairs (BMVBS) to achieve planning and development by the principle based on "Design for All".

The relevance of the differentiation between subjective and objective safety at zebra crossings arises from the fact that the very mutual conclusion of the available safety studies consider zebra crossings to be objectively benefiting the safety of pedestrian traffic in comparison to crossings outside of crossing facilities. These studies do not come to a different result in the case of vulnerable pedestrians. Based on the national accident statistics zebra crossings also are not particularly striking as areas with frequent accidents. At first view this stands in a certain opposition to the subjective perception of safety at the zebra crossings by the pedestrians. The higher absolute safety level of zebra crossings is probably due to the higher attention and consideration generally paid to pedestrians by the vehicular traffic at these crossing aids. However, the safety level in practice remains significantly lower than indicated by the legal requirements. All available studies about this topic show - to varying degrees - a serious lack of acceptance of the existing guidelines for zebra crossings by the vehicular traffic. This frequent disregard for the right of way and general disregard for the pedestrians as part of road traffic must be considered of significant influence on the subjective safety of pedestrians, especially since pedestrians usually are the ones (not the vehicular traffic) that adapt their behavior to cope with possible conflicts at zebra crossings. A significant shortcoming of safety investigations about crossing aids is, however, that they are usually based only on the observed crossings at the zebra crossing, which means in consequence that crossings which do not take place due to anticipated safety problems are not included in their results.

As a contribution to both subjective as well as objective safety of pedestrians it is therefore strongly recommended to increase surveillance of the legal guidelines at zebra crossings. At the moment the control imposed in this field is not sufficient, which is essentially due to the difficulties of controlling the vague legal terms 'recognizable' and 'moderate speed' and the lack of (semi-) automated surveillance equipment. Part of the recommendation, therefore, is to foster the technological development in this field and simultaneously consider options for a change in the traffic codes to increase their preciseness and hence the controllability of the conducts at zebra crossings.

Moreover, several equipment and design features for zebra crossings not common in Germany today are discussed. Based on this, the use of dialog displays that monitor the speed of vehicles in approach to a zebra crossing is recommended. The function of these displays is to light up and give the driver feedback if the speed limit is not sufficiently met by approaching vehicles at a specific zebra crosswalk. It's further recommended to further investigate effects of sensor-controlled flashing lights at zebra crossings, which are automatically switched on when the presence of pedestrians, in a scientific setup. The recommendation also includes further research of the general visibility as well as the psychological effect of markings at zebra crossings.

Still none of the options under consideration, however, leads to a substantially reduced level of requirements for pedestrians at zebra crossings. The main trade-off between safety and efficiency, depending on pedestrian type is therefore basically maintained. To this end, it is proposed to carry out further research on the combined use of zebra crossings with traffic signals (which is currently not permitted by traffic law), based especially on the existing international experience but also to test the combination using a specific type of setup designed for use in Germany.

It is proposed to use a so-called 'FGÜ-DUNKEL-DUNKEL-Anlage', in which a zebra crossing is combined with traffic lights that are switched off in initial state (but are still ready to use on demand; the signals show 'DARK' = 'DUNKEL' in this state) with an incomplete signal sequence (no RED lights for pedestrians and no green lights for vehicles). The advantages of this system are especially seen in a high ease for strong pedestrians, additional on demand safety for weak road users even beyond the zebra crossing, and an lower impact on driving traffic than at complete signaling. The incomplete signal sequence also ensures that the traffic lights can not at any time display traffic commands that contradict the commands of the zebra crossing. A thorough testing of this system, including the effects on the behavior of users on 'normal' zebra crossings, is essential despite the anticipated benefits.

Finally, it is recommended to give up the actual official german term for zebra crossing 'Fußgängerüberweg' (which is 'pedestrian crossing' in exact translation) in favor of one of the terms 'Zebrastrifen' ('zebra stripes') or 'Zebraüberweg' ('zebra crossing'). Especially in the public awareness the term 'Fußgängerüberweg' is not presumed to be the correct term for zebra crossings and contributes to confusion, in the terminology of professionals and scientists there is no advantage in the use of this specific diction.

Felix Weidner, June 2012