Differences Between Safe and Unsafe Zebra Crossings in Switzerland

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Content

Introduction

In Switzerland between 33 % and 40 % of all injured pedestrians are involved in accidents at pedestrian crossings that are not controlled by crossing lights. The proportion of fatalities is a little lower, i.e. the injuries are somewhat less severe. The rather large proportion of victims at a location designed for pedestrian safety was the starting point of our investigation. The aim of the study was to find differences regarding design/layout and operation between safe and unsafe pedestrian crossings in order to be able to give advice as to their improvement.

Selection of crossings to be evaluated

At a first step safe and unsafe pedestrian crossings had to be identified. Communities all over Switzerland were asked to report pedestrian crossings with an occurrence of 2 or more accidents with injured victims within the last 2 years. The criterion chosen seems to be rather soft, but locations with a higher incidence of accidents are considered black spots which are usually subject to rapid changes. Nonetheless we had 1 crossing with 5 injury accidents in the last two years. 110 crossings were reported from german- and french-speaking cantons. Out of these a 50 % random sample was selected for participation in the study. Due to organizational reasons, observations could only be made at 45 of the 55 selected pedestrian crossings.
The next adjacent pedestrian crossing on the same road was chosen as a control, presuming no accidents had occurred there within the last two years. This eliminated the confounding variable of average daily traffic which, of course, was identical for the experimental and control group.

Selection of dependent variables

Three types of dependent variables were analyzed. First of all, the variables concerning the design of the pedestrian crossing, second, variables of operation and third, variables relating to the accidents that had occurred. The variables are listed in the following three tables.

Design variables
Lighting
Road Width
Pedestrian Traffic Island
Total Number of Traffic Lanes
Placement of Pedestrian Crossing Within the Road Network
Vehicle Accessibility to Pedestrian Waiting Areas
Visibility
Recognition of Signs
Traffic Sign "Location of a Pedestrian Crossing"

Operating variables
Amount of Pedestrians
Motorized Traffic Speed

Accident Variables
Date
Day of Week
Time
Lighting Conditions
State of Road
Weather
Conflicting Object
Side of Road From Which the Pedestrian Departs
Side from Which the Car is Coming
Number of People Injured
Number of People Killed

Data collection

Data collection differed depending on the sources of data used. The design variables were observed by a traffic engineer who conducted the measurements at the scene. The operating variables were observed by students who counted pedestrians crossing the streets and who measured the speeds of cars every five minutes. The speed observations were done in such a way that the drivers could hardly see the speed guns until after having passed the observer. The observations were conducted from 7 o'clock in the morning to 7 o'clock in the evening. For all accidents that had happened at the selected sites the accident protocols (that had to be filled out by the police) were requested from the communities. Relevant information from the protocols was transferred into another form and then entered into the data set.

Results

Design Variables

- Traffic Islands were found significantly more frequently at the safe than at the unsafe crossings: 45% vs. 30% (Chi-Square=5.05, df=1, p=.025).
- At safe pedestrian crossings an unhindered view to the left (more than 100m) could be found more frequently than at unsafe crossings (62% vs. 69%, Chi-Square=6.48, df=1, p=.011).
- The results concerning the traffic sign "Location of a pedestrian crossing" are twofold. A significant difference between safe and unsafe pedestrian crossings could be found concerning the presence of the sign. At 57 % of the unsafe and at 63 % of the safe crossings the sign was present (Chi-Square = 29.5, df=1, p=.000). Moreover the visibility of the sign differed among the crossings. The sign could be seen from a distance of more than 100 m in 42% of the unsafe and 54% of the safe crossings.
- At unsafe pedestrian crossings the proportion of roads with more than two lanes was higher than at the safe crossings (27% vs. 18%, Chi-Square=14.9, df=6, p=.021). With regard to the other design/layout variables no significant differences were found.

Operating Variables

- The amount of pedestrians that were observed at the safe and unsafe pedestrian crossings was quite different: there were almost twice as many pedestrians at the unsafe crossings. For example: in the six hours with the highest number of crossings maneuvers 533 vs. 294 pedestrians were observed. This difference is highly significant (t=2.77, df=41, p=.008).
- Small but highly significant differences were also found between the speeds driven at the crossings. At the safe crossings the speed was 44 km/h vs. 41 km/h at the unsafe pedestrian crossings (t=-15.3, df=8260, p=.000).

Accident Variables

An attempt was made to relate the accident variables, i.e. the characteristics of the accidents, to certain design and operating features. Only one significant result could be found. When the road is dry almost twice as many accidents occurred on roads with more than two lanes than on roads with only two lanes (1.0 vs. 1.8 accidents, F=8.65, df=1, p=.005).

Conclusions

The present study indicated that differences exist in the design and operation of safe and unsafe zebra crossings. It should be noted that part of the differences in the number of accidents may be accounted for by the number of pedestrians crossing, i.e. by higher exposure. Still, even if the number of pedestrians was only half of that found at the unsafe crossings the number of accidents would still be higher than at the safe crossings. Thus, the classification of safe and unsafe still seems to be justified.

The lower speed at the unsafe pedestrian crossings probably reflect the behaviors of the drivers who, upon reaching a frequently used crossing, might somewhat lower their speeds in order to be able to react rapidly if necessary. It must be stressed that only cars where measured which were not hindered by other cars or pedestrians, i.e. the drivers could freely choose their speeds.

The results warrant certain changes in the design (and the norms concerning the design) of pedestrian crossings:

- No zebra crossings should be constructed over roads with more than two lanes.
- Traffic islands should be used whenever possible, even if some construction work has to be done.
- Pedestrians should have an unhindered view of a 100 m and more towards the left.
- The sign "Location of a pedestrian crossing" should be made obligatory and visible from a distance of more than 100 m.

A more general conclusion of this research project is that the norms that are being used are often not based on empirical evidence. As an example I would like to present the recommendations regarding minimal sight distances depending on the speed driven.

Minimal Sight Distances in Depending on the Speed Driven (V85)

V85-Speed (km/h)	Swiss Recommendation	New Zealand Recommendation
40	40	55
50	55	75
60	70	95
70	90	120
80	120	150

The Swiss recommendations were derived from the usual formulae. For safety reasons the derived values were doubled. As we can see from the differences in accidents, the values in the norms do not seem to suffice. My opinion is that the attention of the drivers was sufficient most of the time, but that the recommendations are too conservative under extreme conditions.

I would like to conclude my presentation encouraging you to check the norms with regard to their safety effects. The norms are not an end in itself and not sufficiently justified by a mere expert judgements without an empirical basis.

Can weather-related traffic management and information improve safety?

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1. Introduction

Road safety has steadily improved in Finland during the last years except for accidents on wintry road conditions. The number of these accidents has remained the same during the last years. Ca. 25% of all fatal accidents occur on icy or snowy road surfaces, and an additional 15% in other adverse weather conditions.

The primary measure used to decrease accidents on icy and snowy roads is to improve the road surface conditions with the help of road maintenance actions (de-icing with salt, sanding, snow removal, etc.). Winter road maintenance usually applies the following procedure:

1. the personnel at the Road Weather Monitoring Centre (RWMC) starts to suspect of slipperiness on the basis of data from automatic weather monitoring stations, CCTV cameras or reports from neighbouring road offices
2. the on-duty person at the local road office is informed
3. the local road office checks the slipperiness on location
4. the local road office reports possible slipperiness and calls for maintenance actions
5. the road maintenance unit acts accordingly

This procedure is quite efficient but takes time. Time is critical as the accident risk in the hour preceding maintenance actions is estimated to be 12 times as high as it was twelve hours earlier (Öberg 1993). Hence, the Finnish National Road Administration (Finnra) especially aims to improve safety in the period from first indication at the RWMC to the start of maintenance actions on the road section by warning road users about the possible slipperiness.

The warning of road users should be useful as on slippery road surfaces only 14% of drivers estimate the road to be slippery, while more than 50% regarded the friction to be quite normal (Heinijoki 1994).

On average, drivers adapt their speeds to the road surface conditions. The mean speed on a slippery road surface is ca. 4 km/h lower than in good winter conditions, and the standard deviation of speeds is also lower due. This is due to the fact that the highest speeds decrease especially much compared to other speeds (Saastamoinen 1993). Theoretical calculations concerning stopping distances, however, have proven this adaptation to be insufficient in