

Safety-related aspects of traffic lights

Negotiating road junctions is among the most difficult tasks the road user has to face in today's road traffic system. Roundabouts are increasingly replacing traffic lights because the former are safe and economical to maintain. However, this is not always possible, especially at busy junctions. Traffic lights will remain an important part of our road network. As this study shows, traffic lights can be optimized in respect of safety considerations.



Problem and Objective

Of all accidents recorded by the police, only about 3 per cent occur at traffic lights. Nevertheless, junctions controlled by traffic lights are often considered to be dangerous, i.e. localized accident spots. The purpose of this study is to provide information about why accidents occur at these junctions despite the protection that traffic lights are intended to offer. It follows a pilot study with the same objective, although of smaller scope and which primarily served to provide rough indications of possible contributory factors.

Procedure

This study was conceived as a retrospective observation study in which a random selection of traffic lights formed the sample. A total of 16 cantonal and 20 municipal authorities were asked to supply details about existing traffic lights and the associated accidents. A survey of data relating to the accidents that occurred at the selected traffic lights was carried out, configuration-specific features recorded and traffic censuses conducted. Only those types of accident were included in the analysis that suggested a connection between

the occurrence of the event and the configuration-specific features. Accidents that were clearly not connected with configuration-specific features (for example those involving drunk drivers) were excluded.

In the case of the configuration-specific features, the characteristics of the geometry and the equipment were extended by the characteristics of the immediate surroundings. Variables in the following feature categories were recorded in the analysis: traffic lights, traffic lanes, road signs, signposts, perceptibility and road layout.

The average daily traffic (ADT) served as the measure of exposure for the approach roads.

Results

In all, 346 approach roads were surveyed, of which 103 (29.8 per cent) had a green light that was full (i.e. unmasked) whereas 243 (70.2 per cent) featured a green arrow. Approach roads with a full green traffic light had an accident rate of 4.4 accidents per 10 000 vehicles, roughly 50 per cent more than approach roads with a green arrow traffic light (2.95 accidents per 10 000 vehicles). By using the statistical method known as Poisson regression, an attempt was made in each case to develop a model that would enable the dependency of the accidents on various contributory factors (configuration-specific features and exposure) to be represented and forecast. It turned out that accidents at traffic lights are difficult to predict based on configuration-specific features alone; no model could be found that explained more than 50 per cent of the variance in the accidents actually observed. This means that other factors not included in the analysis must make a contribution towards explaining how the accident occurred (for example, characteristics of the driver involved, such as age, gender, etc. and/or circumstances, such as time of day, road conditions, etc.).

In the models found for the various types of accident 4 characteristics stood out. These occurred repeatedly as predictors for the accident frequency – irrespective of the type of traffic lights: the average daily traffic (ADT), possible obstructed vision due to vehicles turning off, the topography of the approach road and the presence of side roads in the zone where the traffic lights are recognizable. When the traffic volume increases, so does the accident risk in the accident categories surveyed. A marked increase in accident risk also occurs when vehicles turning off can obstruct vision. Furthermore the influence of the topography of the approach roads to traffic lights was evident: there is an increased risk of green arrow and rear-end collision accidents at green arrow traffic lights involving a conflict situation on approach roads which slope downwards. A similar situation applies to accidents occurring after a red light had been run on approach roads that slope upwards. Finally, the existence and number of side roads in the zone where the traffic lights are recognizable has an effect on accident frequency: the accident risk increases in the case of green arrow traffic lights as the number of side roads (in the approach zone) increases.

Conclusions

Recommendations concerning how the incidence of accidents could be reduced were drawn up for the most significant predictors per accident type. These can be used as a planning tool by those who plan traffic lights in order to assess the safety level of the traffic lights before they are commissioned. Furthermore these recommendations can be applied when existing traffic lights are checked and/or updated. The most important recommendation is that:

Wherever possible, full green (i.e. unmasked) traffic lights should be avoided!

By way of an example, the following additional measures are suggested: measures for reducing vehicle speed, adjustment of the slope inclination in the traffic light approach zone, elimination of potential conflict situations, elimination of potential obstructed vision, and checking of the signpost and road sign concepts.

Source

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