International Co-operation on Theories and Concepts in Traffic Safety

Measuring Local Road Safety by Automated and Manual Video Analysis: Comparison at Different Spots

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Introduction: Until now, local road safety in Switzerland has been assessed mainly on the basis of actual accidents. From a statistical point of view, accidents are rare in relation to the total volume of traffic, so this method is subject to a certain degree of imprecision. In addition, the analysis can only be carried out retrospectively and does not always allow concrete conclusions to be drawn about the shortcomings of the infrastructure.

Research Methodology: To meet the goal of an alternative objective assessment of the safety of, for example, a road, safety indicators and a method for measuring them have been searched within this research project. Video analysis was defined to be subsequently tested in field trials at a total of eight investigation sites with different characteristics. The measurement results of the selected method were subjected to a further examination and compared with the results of the accompanying investigations and the accident analyses.

Results: In consideration of the available measurement methods, the indicators "Time To Collision" (TTC) and "Post Encroachment Time" (PET) were identified as applicable. With regard to the desired requirements and expectations of the surrogate method, the video-based approach emerged as the most appropriate. Automated analysis procedures are already available which include measurements of the aforementioned safety indicators based on extracted movement trajectories of road users.

In conclusion, the following findings were derived from the field tests:

- The selection of the location and the recording perspective are of significant importance for the subsequent analyses.
- It was anticipated that external conditions, such as weather and lighting, would have a greater impact on the quality of the results of automated video analysis than was observed.
- The automated trajectory extraction, the detection of objects in the video image and their classification produced satisfactory results in some cases. The traffic volumes could generally be determined with a high degree of accuracy, with some exceptions for pedestrian and bicycle traffic as well as heavy vehicles.
- The measurability of the safety indicators is constrained by the applications employed. The TTC indicator demands a high degree of accuracy in the extracted trajectories and their transformation into a coordinate system. This level of accuracy could not always be attained with the experimental setup employed. In this context, the recordings from the oblique perspective proved to be disadvantageous.

- It should be noted that the indicator PET is only suitable for describing safety when further criteria are taken into account, such as the permitted speed of road users. For more detailed analyses, it is important to differentiate encounters into conflict types.
- It is essential to subject the results of automated analyses to a critical examination and post-processing in order to identify and address any false-positives, false-negatives and further inaccuracies.
- A comparison of the results of automated analyses with those of the accompanying manual conflict analysis revealed significant discrepancies. These not only reflected the methodological differences between the two methods, but also the limitations of the manual conflict analysis itself. Furthermore, the validation of the results based on the actual accident was also limited, primarily due to the small number of accidents at the study sites. At least, in the detailed analysis, correspondences of characteristics regarding accident types and conflict types could be demonstrated.

Discussion and conclusions: In summary, the automated analysis was unable to achieve the desired quality at any selected locations. To obtain valid measurement results for the defined safety indicators and other essential parameters for the overall assessment of road safety at an infrastructure facility, a higher level of quality would be necessary. The tested method provides initial indications of irregularities in the traffic flows, which must be verified by means of qualitative analyses.

The approach may be suitable for supporting analytical road safety work under certain conditions. Following on from the existing safety instruments (ISSI) for road safety in Switzerland, possible cases of application lie in the timely review of newly built infrastructure with specific interest (possibly as a recommendation from a Road Safety Audit), within a Road Safety Inspection, a Black Spot Management or an Individual Accident Management as well as to analyse the effects of realised measures in the sense of a before-and-after study. It is important to note that the suitability of the method is in part dependent upon the local situation and existing framework conditions. These include, for example, the dimensions of the facility to be investigated and its equipment (especially lighting), existing mounting options for recording devices, any visual restrictions, and the traffic composition. Further recommendations that could be derived regarding the use of methods concern the procedure for conducting surveys as well as the examination and post-processing of the results of the automated evaluations.

The research has demonstrated that there is still a pressing need for further development of automated evaluation technologies. This is to enhance the quality of the achievable measurement results in general and to facilitate the calculation of safety indicators and their applicability. There is also the question of new survey techniques to be raised, which allow the capture of video data from a more suitable perspective over a longer period of time. Further research is required to develop suitable parameters for describing the safety level, which are to be determined based on automatically measurable indicators and parameters.

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