ELSEVIER

Accident Analysis and Prevention 38 (2006) 379–385

ACCIDENT ANALYSIS & PREVENTION

www.elsevier.com/locate/aap

Estimating the severity of safety related behaviour

Åse Svensson*, Christer Hydén

Department of Technology and Society, Lund Institute of Technology, Lund University, Box 118, SE-22100 Lund, Sweden

Received 14 October 2005; accepted 18 October 2005

Abstract

The aim of this work is to be a starting point for a more thorough description and analysis of safety related road user behaviour in order to better understand the different parts forming the traffic safety processes. The background is that it is problematic to use analysis of crash data and conflict data in the everyday traffic safety work due to low occurrence rates and the focus on rather exceptional and unsuccessful events.

A new framework must consider the following aspects: (1) The importance of feedback to the road users. (2) Inclusion of more frequent events, "normal" road user behaviours and the possibility to link them to a severity dimension. (3) Prediction of safety/unsafety based on the more frequent events.

By constructing severity hierarchies based on a uniform severity dimension (Time to Accident/Conflicting Speed value) it is possible to both describe the closeness to a crash and to get a comprehensive understanding of the connection between behaviour and safety by both considering unsuccessful and successful interactive situations. These severity hierarchies would make it possible to consider road users' expectations due to feedback and estimate its safety relevance.

Keywords: Traffic; Safety; Behaviour; Conflicts; Interaction; Feedback

1. Introduction

The aim of the work behind this paper is to extend the traffic safety assessment concept to also include normal road user behaviours, thus not only exceptional behaviours such as those leading to crashes and/or serious conflicts. The goal is to provide a framework for a more thorough description and analysis of road user behaviour in order to better understand what we define as the traffic safety processes, i.e. the interactional processes that define events of different severity.

2. Background

2.1. Interaction

Traffic is interaction—all events in traffic contain some kind of interaction but of course to varying extent. There is interaction between road users and there is always interaction between the road user and the road environment. In this paper the term interaction is restricted to the relation between road users. The interaction between road users can be described as a continuum of safety related events (see Fig. 1).

This pyramid shows how few and exceptional those events are that we usually base our safety estimates on, i.e. the crashes, rarely also including the serious conflicts.

2.2. Need for surrogate measures

The traditional way of approaching traffic safety has mainly been concerned with the occurrence of traffic crashes and their consequences. There are, however, disadvantages with the use of crash data analyses and these have been discussed extensively in several reports, e.g. Englund et al. (1998), Grayson and Hakkert (1987). (1) Crashes are rare events and are therefore associated with the random variation inherent in small numbers. (2) Not all crashes are reported and the level of reporting is unevenly distributed with regard to, e.g. type of road users involved, location, severity of injuries, etc. (Berntman et al., 1995). (3) The behavioural or situational aspects of the events are not covered in police crash data (Berntman, 1994). Crashes are also exceptional in the sense that they are a collection of events where all alternatives to handle the situation safely, have vanished one by

* Corresponding author. Tel.: +46 46 2229125; fax: +46 46 123272.
E-mail addresses: Ase.Svensson@tft.lth.se (Å. Svensson), Christer.Hyden@tft.lth.se (C. Hydén).

0001-4575/$ – see front matter © 2005 Elsevier Ltd. All rights reserved.
doi:10.1016/j.aap.2005.10.009

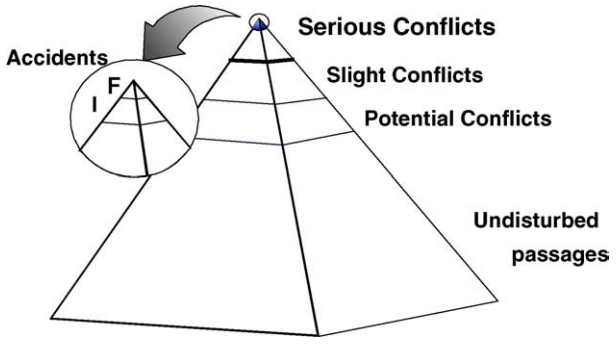

Fig. 1. The pyramid—the interaction between road users as a continuum of events (Hydén, 1987).

one. This is indeed exceptional compared to most other events that actually are handled safely (though to different degree). Thus, we need to get a more comprehensive understanding of the connection between behaviour and safety by both considering unsuccessful and successful interactive situations. The need for surrogates or complementary methods for crash data analysis is consequently high—the Traffic Conflicts Technique (TCT) is such a method.

A conflict is a situation where two or more road users approach each other in time and space to such an extent that a collision is imminent if their movements remain unchanged. The development of TCT has shown that serious conflicts contain most of the qualifications lacking with crash data analysis. Serious conflicts do for instance possess the quality of being an indicator of a breakdown in the interaction—a breakdown that could correspond to the breakdown in the interaction preceding a crash. A serious conflict is also, like the crash, a situation that nobody puts him/herself into deliberately—the situation is perceived as being too threatening (Hydén and Ståhl, 1979).

The relationship between serious conflicts and injury crashes reported by the police has been elaborated on and established through two validation studies. Hydén (1987) deals with three samples of data. The product validation part produces a set of conversion factors, i.e. establishes the relationship between the number of crashes and the number of serious conflicts. In the process validation part analyses are conducted regarding similarities of the processes preceding crashes and serious conflicts. Analyses showed big similarities between crashes and conflicts when the comparison was based on Time to Accident (TA) values and Conflicting Speed (CS). It also showed that the distributions of different types of evasive action were very equal for crashes and conflicts. In Svensson (1992) analyses on the product validation of the Swedish TCT show that at lower crash frequencies it is preferable to use conflicts instead of crashes when estimating the expected number of crashes. For further information about the Swedish TCT and other TCTs see also, e.g. Grayson (1984).

Many of the shortcomings in crash data analyses are provided for with the use of TCT, but not all. Sometimes also the serious conflicts are too few to obtain statistically significant estimates at assessment studies. The analyses of serious conflicts do also have the same angle of approach as the crash data analysis, i.e. the primary focus is set on rather exceptional and unsuccessful events; unsuccessful in the sense that road users have to take strong evasive action to avoid a crash. Experience with the TCT has, nevertheless, shown that it is possible to include less severe events than crashes, i.e. serious conflicts, and reach better understanding of the traffic safety process.

3. Extension of the concept

As the task here is to try to explain the relationship between road user behaviour and safety this implies an unambiguous need for widening the scope of traffic safety and safety related events. There are at least three fundamental issues that are important to consider, to link and to interpret when structuring a new framework.

- The importance of feedback to the road users.
- Inclusion of more frequent events, “normal” road user behaviours and the possibility to link them to a severity dimension.
- Improve prediction of safety/unsafety.

3.1. The importance of feedback to the road users

What is it that makes one traffic environment more crash prone than another? A basic hypothesis in this paper is that the feedback to the road users can be an important explanatory factor. The occurrence of crashes can be due to lack of feedback but also due to the fact that existing feedback is misleading or perhaps incorrectly interpreted.

The importance of feedback to road users has not least been acknowledged when traffic education for children is discussed. According to Thomson et al. (1996) referred to by Whitebread and Neilson (1996) pedestrians require a range of fundamental skills to interact safely in traffic. The pedestrian has to, among many other things, make judgements of whether the crossing place is safe or not by co-ordinating past experience, present information and predictions about the future. Children lack this cognitive ability and they have due to obvious reasons not yet had the time to achieve feedback based on previous experiences in traffic. Thus, practical training in traffic is crucial.

Crash statistics also clearly show the need for practical training and the importance of feedback. Young drivers with a fresh driver’s license is a road user group with high crash risks. Experience obviously plays an important role here. It is, however, according to Evans (1991) reasonable to in addition assume that the over involvement by young road users in traffic crashes must involve more than lack of driving experience as the tendency is the same for pedestrians as for car drivers at that age.

Feedback from interactions is most likely a very important part of the learning process and the more obvious feedback the road users have got, the more influence it has on their behaviour in similar situations/environments.

3.2. Inclusion of “normal” road user behaviour

3.2.1. Criteria of events in the framework

We are looking for a framework that handles predefined events that are much more frequent than injury crashes and seri-