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Accidents between freight vehicles and bicycles, with a focus on urban areas

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Abstract

Given the growth in urban areas, many cities are developing freight initiatives that include defining policies related to land use and infrastructure, while at the same time implementing transport policies that promote cycling and building cycle specific infrastructure. Growing numbers of trucks and cyclists result in increased safety concerns. Knowledge of risk factors related to accidents between trucks and bicycles can contribute to decisions regarding planning and infrastructure design that reduces the occurrence and consequences of these accidents. The objective of this paper is to explore characteristics of accidents between trucks and bicycles in urban areas in Norway and identify relevant risk factors.

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Keywords: Road safety; Urban areas; Cyclists; Freight traffic; Accident analysis

1. Introduction

As urban populations grow and cycling oriented policies are implemented in many cities, cyclists' safety concerns are also increasing. Safety between bicycles and freight vehicles (referred to as "trucks" further in the text) are of specific concern given the size and mass differential of these two road users and the severity of their potential accidents.

This paper investigates accidents between trucks and bicycles in Norway, with a specific focus on urban areas, in order to identify the infrastructure related risk factors. The current Norwegian National Cycling Strategy identifies a goal that at least 8% of all travel should be done by bicycle by 2023 (compared to 4% in 2009) and that 80% of children and students should walk or cycle to schools. Together with local transport policies, the conditions for cycling in many cities are improving and it is thus possible to expect an increase of cycling in urban areas, as described by Dozza & Werneke (2014). Meanwhile, the number of trucks and distances driven by them are also growing. According to Statistics Norway (2015), the number of vehicle kilometres driven by trucks increased annually in average by 4.6% in the period from 2009 to 2014. This rise, both in bicycle and truck volumes, carries several challenges, with road safety being one of the most significant.

While overall road safety has improved over the past 15 years in both Norway and EU, safety of cyclists (and other vulnerable road users) is still a large concern (ETSC, 2015). Degraeuwe et al. (2015) summarised that the probability and consequences of an accident are higher for cyclists than for car users. Particularly for Norway, Elvik (2009) found that injury rates per million

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kilometers of travel for various transport modes indicate a considerably higher risk of injury accidents for cyclists than travel by car or bus (data for period 1998–2005). The current Norwegian National Road Safety Plan (2012) estimates that the risk of being killed or severely injured per kilometre travelled is three times higher for cyclists than for car occupants.

Presence of trucks is one of the factors that contributes to higher risk for cyclists (Allen-Munley & Daniel, 2006). Trucks contribute more significantly to severe injury accidents compared to other types of vehicles (Ming et al., 2014). Heavier vehicles have greater momentum at a particular speed than passenger cars (Kim et al, 2007) and vehicles with higher hoods cause greater injuries (Maki et al, 2003). As result, cyclists involved in accidents with trucks are usually more severely injured than cyclists who collided with a car, as shown by Manson et al. (2012), Kaplan et al. (2014) and most recently by Kröyer (2015). Thus, **t**ruck-bi**c**ycle **a**ccidents (referred to as "TCA" further in the text) are considered as one of the most serious type of event a cyclist can experience, while a truck driver is usually not physically injured. As Johannsen et al. (2015) and Seiniger et al.(2015) described, particularly turning accidents, and especially those associated with blind spots, are regarded as the most serious type of TCA. Niewoehner & Berg (2005), Sagberg & Sørensen (2012) and Volvo Truck (2013) pointed out, that the reduced field of vision of truck drivers (both direct and indirect) contributes to those blind spot accidents. Based on a German in-depth accident study by Niewoehner & Berg (2005), construction and municipal vehicles were exceedingly often involved in turning accidents.

According to these previously mentioned studies, most of TCA take place in urban areas, in daylight, under good road conditions and during low speed manoeuvres. With growing numbers of cyclists and trucks in urban areas, TCA have been recognized as a severe road safety problem in many cities. In London, for example, heavy trucks have been the most frequently involved vehicle in accidents resulting in cyclists' deaths for more than two decades, as it was identified in a study by McCarthy and Gilbert (1996), and more recently by Morgan et al. (2010) and Manson et al. (2012). There is still a lack of understanding about TCA, especially how infrastructure influences their occurrence and potential consequences. Such knowledge is essential to provide infrastructure, which accommodates the growing number of cyclists and ensure their safety (and thus further catalyse cycling), while at the same time providing for the needs of trucks, especially in urban areas. Thus the impact of infrastructure and associated land use and planning efforts, as related to TCA in urban areas, is a focus of this research. Furthermore, it aims at developing insights into where, why and how these accidents occur, in order to provide infrastructure-related safety recommendations.

2. Data

Police data forms the basis for official accident records in Norway. They are further verified by Norwegian Public Roads Administration (NPRA) and The Central Bureau of Statistics (SSB), and then collected within The National Database of Road Data (NVDB). Additionally, several accident analysis groups (UAG) are working within the NPRA to conduct in-depth analysis of all fatal accidents in Norway (since 2005). Both sources were used within this research. Note that Norway uses the most common definition of road fatality, i.e. 'dead within 30 days as a consequence of the road accident'.

For period 2000-2014, NVDB contains 271 TCA. Ten percent of those TCA had fatal consequences, while for other types of cycle accidents; this share was only 1.2%. The percentage of fatal TCA from all fatal cycle accidents was almost 20% which is one of the highest in Europe, as can be seen in Evgenikos et al. (2016). In addition, one should note the long-term decreasing trend in annual numbers of TCA (as well as for other types of cycle accidents in Norway); although, there is no such decreasing trend in numbers of fatal TCA (see Fig. 1).

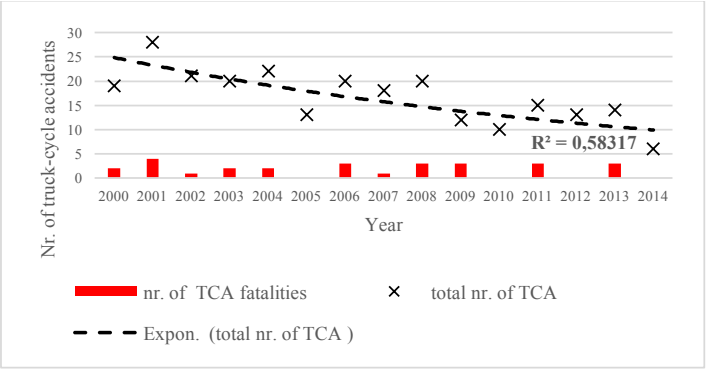

Fig. 1. Annual numbers of all and fatal TCA in Norway (2000-2014)

Because of the nature of police data, several factors may limit the accuracy of road safety analysis relying on this data:

- Underreporting is typically large for cycle accidents, especially for single and slight injury accidents. It would be possible to expect higher reporting level for TCA, as the consequences of those accidents are more severe and there is always a motor vehicle involved. Nevertheless, as Elvik (1998, cit in Erkne & Elvik, 2007) estimated, injury accidents where a large truck is the heaviest party and a cyclist is the counterparty have the mean level of reporting of only 54% in Norway.