Precision of congestion warnings: Do drivers really need warnings with precise information about the position of the congestion tail

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Abstract

In a driving simulator with a motion system, warnings were provided to N = 16 participants (25-72 years) en route to the tail of a congestion. Two different kinds of congestion tails were simulated. In the first, the speed of the surrounding traffic was abruptly reduced before the tail of the congestion was reached and in the second, the speed of the surrounding traffic was gradually reduced. In the simulated runs, congestion warnings were given at different distances ("3.5 km" vs. "1.5 km" vs. "0.3 km" prior to the congestion tail) and the precision of the warnings ("precise warning": distance to the congestion is indicated and updated regularly vs. "imprecise warning": without a clear distance indication) was varied. Furthermore, the tail was approached without any warning. Drivers were asked to work on a secondary task (handling a menu system) during the entire run. Overall, precise warnings have greater effects on driving safety when approaching a congestion tail than imprecise warnings. Driving safety was at its lowest when drivers approached the congestion tail without any warning. Precise warnings given 1.5 km prior to the congestion tail show the highest driving safety and were preferred by drivers.

Introduction

Motorway accidents predominantly occur when speeds vary and traffic is dense. According to Lee, Saccomanno and Hellinga (2002), approximately 88% of accidents on US-highways are caused by drivers who abruptly decelerate or by non-moving vehicles. Similar results were reported by Oh, Oh, Ritchie and Chang (2001) as well as by Zheng, Ahn and Monsere (2010). In Germany, approximately 30% to 40% of motorway accidents occur because: (1) the geometry of the road ahead is badly visible and (2) slowly moving or stopped traffic (German Federal Statistical Office, 2010). The latter scenario is typical cause for traffic jams on motorways.

In the following, the term "congestion tail" is used to describe the transition between free and congested traffic (Treiber & Kesting, 2010). Kerner (1999) defines the congestion tail as the region in which traffic volume, traffic density, and mean velocity varies within a very short section of the motorway. Two types of congestion tails can be distinguished (following Buld, 2003; Kerner, 2004; Kim, 2002):

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