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). Kernner (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; Kernner, 2004; Kim, 2002):

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