Karolinska Institutet

Institutionen för klinisk neurovetenskap, sektionen för försäkringsmedicin

MANAGING TRAFFIC SAFETY - AN APPROACH TO THE EVALUATION OF NEW VEHICLE SAFETY SYSTEMS

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av
Anders Lie

Huvudhandledare:
Professor Anders Kullgren
Chalmers
Institutionen för Tillämpad Mekanik
Avdelningen för Fordonssäkerhet

Bihandledare:
Professor Kristina Alexanderson
Karolinska Institutet
Institutionen för klinisk neurovetenskap
Sektionen för försäkringsmedicin

Professor Claes Tingvall
Chalmers
Institutionen för Tillämpad Mekanik,
Avdelningen för Fordonsteknik och Autonoma System

Fakultetsopponent:
Professor Nils Petter Gregersen
Hälsouniversitetet i Linköping
Institutionen för medicin och hälsa

Betygsnämnd:
Professor Irene Jensen
Karolinska Institutet
Institutet för miljömedicin
Enheten för interventions- och implementeringsforskning

Adjungerad Professor Lotta Jakobsson
Chalmers
Institutionen för Tillämpad Mekanik,
Avdelningen för Fordonssäkerhet

Professor Emeritus Christer Hydén
Lunds tekniska högskola
Institutionen för Teknik och samhälle
Trafik och väg

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ABSTRACT

Road traffic crashes are killing more than one million road users per year, worldwide. Preventive measures to decrease this number are warranted. Relevant measures can be to introduce systematic road traffic safety management and to improve the safety properties of components in the road transport system. The so called Vision Zero, a holistic system to improve road safety, is built around the general idea to build a ‘‘safe system” based on knowledge regarding human capacity and where no predicted crash or collision results in death or serious injury. A Vision Zero model for safe traffic has been developed to illustrate how different system components interact.

The aim of this thesis was to investigate how two vehicle safety systems, electronic stability control (ESC) and intelligent seat belt reminders (SBR), could deliver improved road traffic safety. Further the Plan-Do-Check-Act approach was investigated as a systematic mean for the evaluation of effects of new safety technologies.

The studies were mainly based on data in the form of police records and field observations. For some aspects, in depth studies of fatal road crashes were used.

ESC systems were focused in two studies. The first study only investigated crash involvement independent of injury outcome level. In that study, a positive effect of ESC was found both overall and for accidents on wet, icy, and/or snowy roads. In a later study with a larger data set, the effect of ESC in crashes with various injury severities was investigated. The overall effectiveness on all injury crash types was found to be 16.7% (95% C.I. 7.4–25.0%), while for serious and fatal crashes, the effectiveness was 21.6% (8.8–34.4%).

The highest effects were found on serious and fatal loss-of-control type crashes on wet roads where the effect was 56.2% (32.7–79.7%) and on roads covered with ice or snow where the effect was 49.2% (19.0–79.4%). It was estimated that for Sweden, that at the time had a total of around 500 vehicle-related deaths annually, 80-100 fatalities could have been avoided if all cars had had ESC.

The effect of SBRs to increase the use of seat belts was studied in eleven cities in Europe, five of them in Sweden. The seat belt use rate in cars without SBR ranged from 69.6% to 96.9%. In cars with SBR, the seat belt wearing ranged from 92.6% to 99.8%. Considering all data, SBR increases seat belt use in traffic with 82.2% (73.6-90.8%).

The fourth study includes an analysis of how safety aspects can be put into the Vision Zero model for safe traffic. An important finding was that the model was helpful in the understanding of how road traffic safety aspects performed and interrelated.

In the last study, fatal crashes of modern cars were studied. The focus was on ESC and SBR. ESC reduced fatal loss-of-control crashes with 74%. Of the nine, loss-of-control cases in cars with ESC, only one occurred under normal driving conditions. The other cases were related to very low friction, loss-of-control initiated beside the road surface, or related to extreme speeding. Seat belt use in fatal crashes was 74% for cars without SBR and 93% for cars with SBR.

The studies in this thesis illustrate how important it was to follow the introduction of new safety technologies, and this from many aspects, all the way to the ultimate goal to eliminate fatalities and serious injuries. The Vision Zero model was helpful in defining how safety parameters interact. PDCA was found to be a valuable approach. As safety systems become more sophisticated and fatality rates diminish, better evaluation processes will be needed.