Institute of Transport Economics
Norwegian Centre for Transport Research

ENGLISH Summary

Fatal road accidents and the Vision Zero

Accident characteristics and potential for accident reduction based on in-depth analyses of fatal road accidents 2017-2020

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According to the Norwegian Vision Zero, the responsibility of road users involve avoiding deliberate violations of rules and regulations. Hence, when deliberate, dangerous and illegal actions contribute to fatal accidents, these accidents can be considered to be "outside of system boundaries", i.e. a transgression of the main premise of Vision Zero. Based on in-depth accident investigations, fatal road accidents from 2017-2020 were classified as inside or outside system boundaries, based on whether deliberate, dangerous and illegal behaviour contributed to the accident occurrence, or to accident severity. Forty percent of fatal accidents were classified as outside of system boundaries. Numerous differences in accident characteristics were identified. Differences in contributing factors in crashes outside vs. inside system boundaries have implications for which countermeasures have the largest potential for preventing each of those two categories of crashes. Crashes outside system boundaries are most likely to be prevented by restrictive vehicle measures like speed limiters, seatbelt interlock, alcolock, and electronic driver's license. Other potentially effective measures are increased police enforcement, faster renewal of the vehicle fleet, and occupational risk management programmes. For crashes inside system boundaries, measures to prevent driver inattention and sleepiness are important. More research to provide knowledge about effective countermeasures against these very prevalent risk factors is also needed.

Vision Zero and system boundaries

Norway's Vision Zero implies that no road user shall be killed or permanently injured as long as they comply with traffic rules and regulations and do not consciously commit acts they know are risky or illegal. Road authorities on their side are obliged to provide a safe road system, which protects road users from serious consequences of unconscious or "normal" errors. Road users who do their best to comply with rules and regulations are considered to operate *inside system boundaries*. On the other hand,

conscious illegal or dangerous road user behaviour, primarily driving under influence of alcohol or drugs (DUI), speeding, and not using a seatbelt, is considered to be *outside system boundaries*.

On the basis of this definition of system boundaries, the purposes of the present study were: 1) to classify fatal crashes as outside or inside system boundaries, 2) to compare the two categories of crashes regarding crash circumstances and contributing risk factors, and 3) to discuss which safety countermeasures have the greatest potential to prevent crashes inside vs. outside system boundaries.

Crash data

The study is based on analysis of data from in-depth investigation of all fatal crashes in Norway during the years 2017 through 2020. Since 2005, cross-disciplinary accident investigation teams of the Norwegian Public Roads Administration study all fatal road crashes in Norway, primarily in order to determine the main contributing factors to the fatalities, related to road users, vehicles, and the road system. In addition to writing a comprehensive report from each crash, they enter information about crash conditions and contributing factors in a database. Contributing factors are classified as either *crash factors*, i.e., factors contributing to the occurrence of the crash, or *injury factors*, i.e. factors that contribute to the fatal outcome of a crash.

A total of 391 crashes were included in the analyses, and 40 % were classified as outside system boundaries.

Crash characteristics

Crashes *inside* system boundaries mainly involve two or more traffic units. They occur mostly during daytime, and they comprise a majority of crashes involving pedestrians, bicyclists and other vulnerable road users.

Crashes *outside* system boundaries are to a much higher degree single-vehicle crashes and are relatively more frequent during nighttime. In most of these crashes (80 %), the road user instigating the crash is the only fatality, compared to 57 % for crashes inside system boundaries. This means that 20 % of crashes outside of system boundaries have fatal consequences for other road users than the person who initiates the crash.

Drivers in crashes outside system boundaries are on average younger than other drivers, and they more often drive without a license and/or in a stolen vehicle.

Contributing factors

Crashes outside system boundaries

The most frequent contributing road user factors in crashes outside of system boundaries are DUI, speeding over the limit for license withdrawal, and failure to use a seatbelt. These factors often occur in combination, and altogether they contribute to 78 % of crashes outside system boundaries. In-vehicle distractions and other clearly

risky behaviour (e.g. illegal overtaking) are also frequent contributing factors to crashes outside of system boundaries.

Vehicle-related factors (mostly related to wheels or tyres) contributed to 18% of the crashes outside of system boundaries. Substandard vehicle passive safety contributed to the fatal outcome in one out of ten crashes.

Concerning road-related factors, off-road objects or other roadside characteristics contributed to fatal outcome of almost one fourth of crashes outside of system boundaries. This is related to a large proportion of running-off-the-road crashes.

Crashes inside system boundaries

The crashes inside system boundaries are more varied, both regarding involved road user groups and contributing factors. For example, both permanent and temporary road conditions contribute to a relatively larger proportion of crashes inside than outside of system boundaries.

Inattention or sleepiness for one or more of involved road users contributed to 42 % of crashes. Inattention is also a frequent factor in crashes with vulnerable road users, often in combination with view obstructions in the vehicle (incl. blind zones) or in the road system.

Crashes involving heavy vehicles are most often inside system boundaries, and road conditions like ice or snow contribute relatively more often in these crashes.

Higher speed than what is appropriate for the driving conditions (e.g. related to ice/snow, curves, pavement, sight distance), although within the posted speed limit, contribute to one-fifth of the crashes. Some of these crashes are considered as jointly caused by poor road conditions and inadequate speed adaptation.

Road characteristics (e.g. inadequate guardrails or roadside objects) contributed to fatal outcomes in about one-fifth of the crashes.

Countermeasures

The potential of a countermeasure to prevent crashes is partly a function of the effect of the countermeasure on factors that contribute to the crash and the prevalence of those factors in crashes.

In addition, prioritization of countermeasures must consider costs, how easily the measures can be implemented, and the current degree of implementation.

Based on these considerations, the following countermeasures were suggested:

- **Technologies to prevent drink driving, unlicensed driving, speeding, and unbelted driving.** Such measures are likely to prevent most crashes outside system boundaries, but the effect will depend upon the way of implementation.
- **Countermeasures against inattention and sleepiness.** These are among the most frequent contributing factors, particularly inside system boundaries.

- **Enforcement and sanctions** of illegal road user behaviour can reduce crashes outside system boundaries. However, the most extreme cases of illegal behaviour are probably difficult to influence by traditional enforcement.
- **Removing dangerous roadside objects and installing guardrails** may reduce consequences of crashes both inside and outside system boundaries.
- **Occupational risk management programmes.** Countermeasures addressing workplaces have a potential to influence a large share of road user exposure and may primarily prevent crashes inside system boundaries.
- **Faster replacement of the vehicle fleet** has a potential to prevent crashes where technical defects or poor vehicle passive safety has contributed and, more generally, crashes involving old vehicles. Such crashes could have been prevented by various driver assistance systems that are more prevalent in modern vehicles. Since drivers operating outside system boundaries more often drive old cars, this measure may have the strongest effect on crashes outside system boundaries.