The effects of studded tires on fatal crashes with passenger cars and the benefits of electronic stability control (ESC) in Swedish winter driving

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A B S T R A C T

This study set out to examine the effects of studded tires on fatal crashes on roads covered with ice or snow in Sweden and also to investigate the extra benefits of electronic stability control (ESC) during the winter months. Two different studies are presented in this paper. Both studies used an induced exposure approach. In the main study, 369 in-depth studies of fatal crashes with passenger cars were analyzed to determine whether loss-of-control (LOC) had been a major component or not. Only crashes involving cars without ESC and equipped with approved studded or non-studded winter tires were analyzed. The additional study used police-reported crashes that occurred during the winter seasons 2003–2010, involving passenger cars with and without ESC. While police records in Sweden do not include any tire information, it was assumed that most cars involved in crashes during the winter period would be equipped with studded tires.

Findings in the main study showed that in 64% of the fatal crashes on roads covered with ice or snow LOC had been a major component. Furthermore, in 82% of LOC crashes, the passenger car was over-steered prior to collision. Studded tires were found to have a statistically significant effect of 42% in terms of fatal crash reduction on roads covered with ice or snow, compared to non-studded winter tires. The effect on dry or wet roads in the winter was negative, although statistically non-significant. In the additional study, it was found that ESC further reduced crashes with injuries by 29%. The benefits on severe and fatal crashes were slightly greater (32%), although the lower 95% confidence limit was lower.

Although studded tires were shown to reduce the risk of fatal crash involvement, compared to non-studded winter tires, the proportion of LOC and over-steering among cars with studded tires was large (59% and 49%, respectively). It was therefore concluded that studded tires do not prevent all LOC crashes, while ESC has benefits in those crashes since this technology mostly addresses over-steering. This is also supported by the fact that the share of LOC fatal crashes is considerably lower for ESC-equipped cars.

This study recommends that non-ESC cars should be fitted with studded tires if they are to be driven on roads covered by ice or snow. If the proportion of studded tires is to be decreased on Swedish roads to reduce the about of hazardous particulates especially in built up areas, from a road safety point of view it is recommended that this should be done in phase with the implementation of ESC on all passenger cars.

1. Introduction

The importance of tires for road safety has been studied over a long period of time. In particular, the importance of winter tires and the influence of studs on winter tires have been subjected to many studies Elvik (1999). This is of extra interest in the some geographical areas, i.e. Sweden, where long and cold winters result in a large proportion of traffic and crashes on roads covered with ice or snow. Approximately 20% of all fatal crashes with passenger cars occur on snow and ice throughout the year in Sweden, while during the winter period the share is about 50%. Naturally, this share varies from year to year (Fig. 1) and between the different geographical regions (Fig. 2).

The effectiveness of studded versus non-studded tires became an issue already in the early seventies, showing large effects on the risk of crashes under icy or snowy road conditions. In a