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## **Seatbelt and child restraint systems**

Thematic File Road Safety N° 6



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## Summary

This thematic file is a summary of the current scientific understanding regarding restraint systems for drivers and passengers of passenger cars (seat belts, child seats, wheelchair transport). This document is intended primarily for the general public, communication services, journalists, the police, etc. and provides an entry for scientifically oriented stakeholders. The main results of national and international surveys are presented in an accessible manner.

The safety belt is a subject of passive safety. The basic principle is to stop unwanted forces and movements by virtue of the principle of energy absorption. The belt was 'invented' in 1959 and is still being developed to this day. Restraint systems, as discussed here, are considered to be useful for everyone, including target groups for whom it may be less intuitive, such as pregnant women. Children and people in wheelchairs have their own dedicated restraint systems in cars. Wearing of seat belts in cars is compulsory in all European countries. In Belgium, wearing seat belts has been compulsory since 1975 for front seat occupants, and since 1991 for rear seat occupants.

The more (passive) safety mechanisms are applied, the more the occupant is protected in case of impact. This is why the belt is usually combined with other safety systems of which the airbag, the belt tensioner and the headrest are the most important ones. Actually, the European airbag 'presupposes' that it is always used in combination with the seatbelt. The effectiveness in preventing and reducing fatal or serious injuries of each of these safety systems has been scientifically demonstrated. However, their effectiveness decreases, or even completely fades, in case of incorrect use.

Because the morphology of children is very different from that of adults, and because it also changes significantly in a relatively short period of time, dedicated restraint systems have been developed for them. They are subject to both European and national rules and regulations. Different types of seats and restraint systems are to be chosen and applied according to the age, weight and height of the child. There are also different ways to 'anchor' the seat. Similarly as for the (young) children, also for people seated in wheelchairs specific solutions have been developed. However, the products for this target group are less subject to European and National rules and regulations.

The safety belt is generally considered to be one of the cheapest but also the most effective safety system. Experts agree that the safety belt saves most lives in case of car accident. However, it is still not always and consistently applied and worn by all vehicle occupants. Objective measurements at European level show that on average 9 out of 10 drivers wear the seatbelt, but some countries still do not exceed 80% or even 65%. The data based on self-reporting show a similar pattern: 82% of the European respondents indicated that they always wear a seatbelt; however, some countries do not exceed 70%. The percentage of seatbelt use in Belgium is currently estimated around 95% and in 2018, there were no significant Regional differences. In all countries, the percentage of seatbelt use is lower for the occupants at the rear of the vehicle. Observational studies show that, on average, only between 20% and 50% of children are fully correctly restrained and between 15% and 30% are in an inappropriate system. This indicates, among other things, that actions still need to be taken to further improve safety. It is estimated that 13 fatalities, 53 serious injuries and 436 minor injuries could be avoided each year in Belgium if all occupants were wearing seatbelts.

Failure to use the safety mechanisms raises serious dangers and risks. Estimating and calculating those risks is a complex matter, partly because there can be several different and determining factors: speed, type of vehicle, type of accident, type of safety system, characteristics of the person, position in the vehicle, etc.

The effectiveness of the safety systems, and in particular that of the safety belt, is still increasing. The most recent estimate is that the seatbelt reduces the risk of fatal or serious injury by 60% in the front and by 44% in the back of the car. The safety belt appears to be more protective for the driver than for the front passenger. The belt also appears to be more effective in preventing fatal accidents than serious injuries. It protects primarily in 'roll over accidents' and frontal impact, and the least in lateral collisions. The speed of impact is also a very determining factor. The protective effect is most significant for low and moderate speeds. From a certain speed on (estimated at 120 km/h), the survival rate is nearly non-existent, both with and without a seatbelt. Not only the impact speed, but also the weight of 'the object' in the vehicle determines the effectiveness of the belt. Calculations indicate that the force (of movement) to be modulated at an impact at 50 km/h is approximately 20 times the weight of the object or person. That is why some people in the front of the car, even if they wear their own seatbelt, can be fatally or seriously injured by unrestrained people in the back of the car.

It is clear that there are nothing but disadvantages to not using the seatbelt. However, one can be exempted from the obligation to wear a seatbelt. The modalities of the legal exemption of the obligation to wear a seatbelt is determined by national law. In Belgium for example, taxi drivers when they are transporting a customer, and police forces in the immediate vicinity of an intervention site are exempt. An exemption can also be granted by virtue of 'important medical reasons'. However, there is no genuine medical consensus on the usefulness and/or justification of this medical exemption.

The safety benefits of passive systems can still be increased by a number of measures. Education and awareness-raising is one of them, along with further technological development, and enforcement. Education and awareness-raising deals mainly with the knowledge aspect of the issue. An important point of attention is the modulation of the content and form of the message in function of the profile of the target group. The basic message is that failure to wear a seatbelt entails serious risks and that, for example, requesting and receiving an exemption from the obligation to wear a seatbelt is equivalent to denying oneself a very important and effective safety mechanism. The awareness-raising actions should be repeated and, if necessary, adapted, on the basis of regular evaluation studies.

Further technological improvements should focus on continuing to optimize the applications and to improve the user-friendliness, whereby the effectiveness of one particular system will, at least partly, be determined (and increased) by the combination with, and alignment with, other systems. An example of this is the increased effectiveness of the airbag when combined with the seatbelt. Another example is the rise in seatbelt use due to the increased presence of seatbelt reminders. Regular police enforcement actions, and associated fines, complete the list of measures. It is clear that consistent and regular enforcement actions are still necessary in order to be able to increase the percentage of seat belt use even further, as the probability of being sanctioned or checked is felt to be very low by those surveyed in Europe. The golden rule seems to be that the effectiveness of each of the measures is increased by combining different measures, for example enforcement actions together with an awareness-raising campaign. Proper enforcement obviously requires unambiguous legislation. An elaboration (e.g. for wheelchair transport) of Belgian legislation and harmonization at European level (e.g. for seatbelt exemptions) are justifiable actions.



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