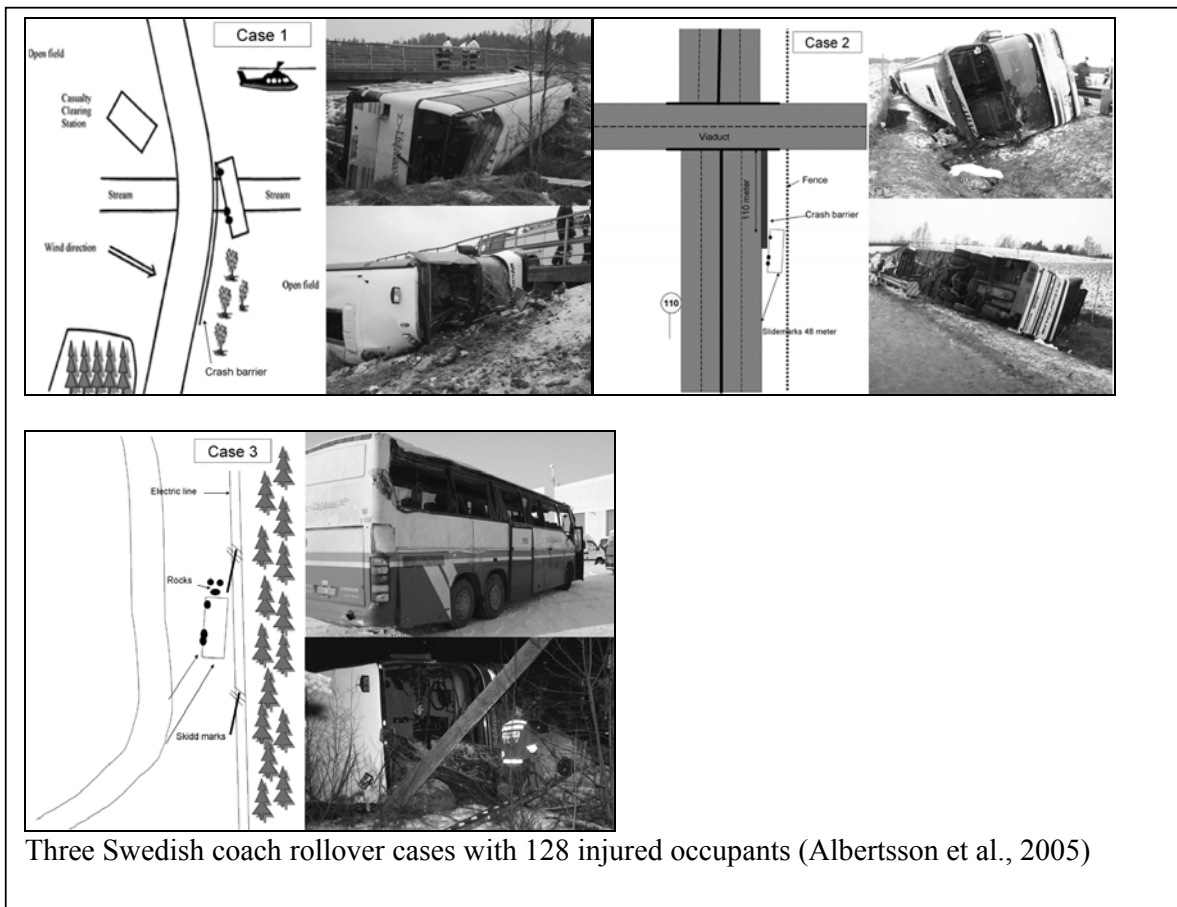


Rollover situation for coaches – a serious risk for injuries

Buses and coaches are rarely involved in severe crashes, but when they are, the number of casualties are usually high due to a large number of occupants travelling in the vehicles. Rollover coach crashes, rolling 90° or more, is one type of severe crash that exposes occupants to high risks of sustaining injuries (Pontus Albertsson, 2005; P Albertsson, Björnstig, & Falkmer, 2003; P. Albertsson & Falkmer, 2005;). Spanish data from 1995-1999 shows a rollover frequency of only 4% for all bus or coach crashes, but the fatality risk in these rollovers was five times higher than in other crash types (Martínez, Aparicio, García, Páez, & Ferichola, 2003). Due to this high fatality risk, it is especially important to study rollover crashes and suggest injury reducing counter-measures.



The single most important safety measure in this type of crash is to keep the occupants inside the vehicle. The relevance of this is shown by the fact that injuries sustained by hitting the interior of the coach or other passengers usually are minor injuries (P Albertsson, Björnstig, Falkmer, Kirk, & Mayrhofer, 2005; Botto & Got, 1996; ECBOS, 2002; Rasenack, Appel, Rau, & Rietz, 1996). Keeping the occupants inside the coach in a rollover crash could be achieved if all occupants are seated and belted and if the windows are intact.

The seat position is also of high importance in rollover crashes. A position near the windows that hit the ground have the highest proportion of injured occupants, compared with other positions in the coach (P Albertsson et al., 2005). The occupants located near these windows are exposed to high risk of being injured due to ejection or partial ejection, when the side windows are broken. A measure that may prevent these occupants from being injured is retentive glass in the side windows and in addition, an impact absorbing material in the window frame. Another measure that may prevent these occupants from being ejected could be to raise the side panel vertically above the occupant's centre of gravity in order to reduce the thorax range of motion towards the side window (P Albertsson & Falkmer., 2005).

The importance of seat belts as a safety measure is shown by the fact that 51% of the severely injured might have experienced an injury reduction if they had worn a 2-point belt. It is, however, important to note the differences between 2-point and 3-point belts. A 3-point belt may provide an injury reduction of about 80% of the severe injuries (P Albertsson et al., 2005). These results were based on three coach crashes, involving 128 injury cases, occurring over a three year period in Sweden. These three cases show a similarity in the crash circumstances i.e. a 90° rollover to the right. This particular crash mechanism is also the most common crash mechanism when coaches are involved in single crashes (ECBOS, 2002).

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