



Engineering Sciences Section – 2008

C49 Rear Seat Safety Hazards: Collapsing Seats, Cargo Shift, Restraint Failure, and Loss of Occupant Survival Space

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The goal of this presentation is to inform investigators, vehicle designers and others of the multiple hazards found in the rear seat areas of passenger cars. This presentation is a companion study to "Safety Modification of Rear Seats and Restraint Systems in Vans and Utility Vehicles to Improve Occupant Protection" that studies rear seat occupant safety in Vans and Utility Vehicles. The presentation will impact the forensic science community by identifying an emerging safety defect trend that has serious implications for occupant safety, especially children. Attendees should obtain a clear understanding of increasing risks to rear seat occupants of passenger cars in frontal and rear impacts, as well as the reasons for those risks.

The goal of this presentation is to present case studies and testing depicting various hazards to passenger car rear seat occupants in front and rear impacts. There are emerging safety risks to children and adults from collapsing front and rear seats. Front and rear seats in various passenger cars have been demonstrated to fail at well below human tolerance levels. This study will inform other researchers about why seat failures are occurring,

Rear seats in late model passenger cars are subjected to increased hazards caused by open bulkheads between cargo areas and occupant seating areas, combined with weak seat structures and attachment hardware. Significant loss of occupant survival space has been seen in both front and rear impacts that are well below human tolerance levels. Because of front and rear seat failure, occupants can be severely injured due to direct contact by other occupants, seat structures, and shifting cargo. Restrained occupants can be trapped between seat belts and the failed rear seats pushed forward by intruding cargo. Additional hazards are created to restrained occupants when rear seats fail, even without cargo shift, because seat movement can lead to submarining under lap belts, as well as misalignment of the upper torso relative to shoulder belts. These combined rear seat safety issues create risk factors for various size occupants that are not foreseeable to typical users of passenger cars, and which are not typically warned about in owner's manuals.

Reasonably similar failures have been seen in a wide variety of passenger cars from various manufacturers. In several instances the most significantly injured person was in the rear seat in a frontal impact, despite being located furthest from the potential intrusion effects affecting the front of the occupant compartment. This includes abdominal and spinal trauma, as well as significant head and extremity injuries that are disproportionate to any injury seen by front seat occupants in the same collision. This is especially significant considering that since 1996, NHTSA and the auto industry have advocated placing children in the back seat to avoid airbag hazards.

Available evidence indicates that some passenger car rear seats are not remotely as safe as they should be, especially for children. Many late model passenger cars have rear seat structures fabricated entirely from plastic, which can and do fail at loads well below human tolerance. Alternative designs will be shown that address some of these hazards.

Rear Seats, Occupant Protection, Child Safety