Redesign of Sleeper Berth of Heavy Duty Truck Cabin for Improved Occupant Safety

Student’s Name | C. Vijesh | APD (PT-2008)
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Academic Supervisor(s) | Vinod K. Banthia
Industrial Supervisor(s)

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Abstract:

With increasing number of commercial vehicles on the road, safety of their occupants has also drawn attention of designers. Like other vehicles, frontal crash is the most frequent accident for heavy duty trucks also. Payload also makes these trucks more prone to rollover. During such accidents, the chances of injuries to occupants resting in the bunks are very high as they are thrown around the interior of the truck cabin.

In this project, a restraint system to prevent the occupants from bouncing around the cab after a frontal accident has been designed. To arrive at a suitable configuration of restraint system, first the problems faced by the users and risk of potential injuries to them in the current lateral sleeping position berths were assessed through literature, market study and interviews with the users. To simulate the phenomenon of sleeping occupant in a truck involved in frontal crash, a multi-body dynamics model of the berth and the interior of the truck cabin were developed. The frontal impact simulation was carried out as per the SAE J2418. The crash pulse and type of dummy to be used were also based on this standard. For the assessment of the existing and new designs, injury levels for head, thorax, pelvis and chest of the occupants were obtained from the simulation. Not only safety, but also ergonomic aspects of the design were considered in the design.

Based on this study a multi-belt system, like a curtain, was developed to restrict movement of the occupants within the confines of the berth, preventing the possibility of them coming off the berth and hitting the driver’s seat, steering and windshield, causing traumatic injuries. The walls in the berth area were provided with softer material to reduce the level of forces experienced by the occupant when they come in contact.

![Modified baseline model with safety systems](image1)
![Unrestrained occupants](image2)
![Restained occupants](image3)

![HIC comparison of safety systems with baseline model](image4)
![Comparison of HIC’s for finalised belt design with all sleeping positions](image5)
![Comparison of belt forces for all sleeping positions](image6)