

## Design of a 3-point Safety Belt System for Enhanced Safety of Bus Passengers



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### Abstract:

Traffic Safety Facts compilation by NHTSA reports that between 1999 and 2003, an average of 40 fatalities and 18,430 injuries of bus occupants occurred per year. Occupant ejection was the reason for 28% of fatalities. Majority of the fatal accidents in buses occurred on roadways with posted speed limits of 40-56 km/h. Since, even city transport buses operate at that speed, an adequate occupant restraint system in those buses is also required. In some buses lap belts are provided but their effectiveness in restraining the passengers in a crash or panic braking situation is uncertain. In this work, structural configuration for a seat that can accommodate a 3 point belt system that provides adequate restraint has been designed and assessed.

Analysis of the structure for the existing lap belt revealed that it does not meet the norms of ECE-R14 standards for safety belt anchorage and exposes occupants to unsafe levels of injuries. Literature Survey revealed 3-point safety belts to be safer than lap belt with lower level of injury. Multi body dynamic analysis was carried out to ascertain the location of the 3 anchorage points for the 3-point seatbelt configuration. A lower injury level as compared to the lap belt configuration was also achieved. Once the location of the seatbelt anchorages for the 3-point configuration was determined a finite element model of the modified structure was created and then analysed to see whether it met the ECE-R14 standards for seatbelt anchorages.

The modified 3-point seat belt configuration seat structure meets the ECER14 regulations and can therefore restrain a passenger effectively. The 3-point seat belt system successfully brought down injury levels as compared to the existing lap belt configuration, thus enhancing the safety of bus passengers.