Numerical Simulation and Analysis of Double-Deck Bus Rollover

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ABSTRACT

The rollover is the most dangerous accident in case of buses and coaches. The collapse of the roof compresses the passengers causing fatalities and series injuries. International requirements for the roof strength of buses and formulated in UN-ECE Regulation 66 (ECE R66), which is specifying “ a simple, reproducible standard accident ” as a test method and the requirements are related to this rollover test. In spite of the long discussion the regulation contains a lot of contradictions, undetermined details. The 20 years (1985~2005) practice being the regulation in force and in use, give the basis to the revision of ECE R66. ECE R66 allows four different methods given possibility for the Type Approval of vehicles: Full-scale rollover test on a complete vehicle; Rollover test on body segment or segments; Pendulum test on body segment or segments; Verification of strength of superstructure by calculation. All of these four methods were carried out using the software LS-DYNA at Da-Yeh University in Taiwan, R.O.C. This paper tries to give technical arguments to this work, and gives a simulation technique for rollover test. This paper will discuss the influence of bus rollover strength by different types and numbers of windows, and completeness of rings. The results of simulation show that the better type of bus has seven windows in each side. Besides, whether the structure of the ring has better strength or not depends on the window pillar. The structure will have better strength if it has vertical window pillar, which makes the entire ring being connected together and looked like a vertical line. This research may provide a useful reference for researchers and -viiibus manufacturers to study or design bus structure, raise the bus safety, and reduce occupant injury and fatality.

Keywords : bus, windows, rollover, FMVSS 220, ECE R66

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