ABSTRACT

Being the largest market in the world, Tractor's rollover appears a serious concern in safety and fatalities are continuing even till today in India. Indian accidental scenario indicates that fatalities due to tractor accidents per year were 5.7 per 100,000 workers whereas in US 29% farmers were killed by rollovers reported by Colorado State University. For such disturbing safety hazards, Roll-Over Protective Structure (ROPS) found to be a better piece of equipment for passive safety. But, ROPS are varying significantly in design therefore their mounting style too. Many axle housings, which are a mounting point of ROPS, do not have square, rectangular or hexagonal shape. Hence, interchangeability of ROPS among the tractors are hinder. Therefore, a mounting fixture was attempted to develop for ROPS retrofitting on Indian tractors with available market ROPS namely A, B C and D.

Testing and performance evaluation has been carried out in accordance with IS: 11821 (Part-II), 1992 identical to ISO: 5700 (2006). Mounting Fixture has been evaluated with due considerations of pre-defined ROPS exposure criteria. For the validation of Mounting Fixture, selected ROPS were installed into test rig and force-deflection curve followed by energy-deflection curve were plotted. The results showed that the geometrical shape of ROPS have no significant effect on the loading energy since p-value was found to be 0.3 at 5% significant level. Similarly, when the plate thickness was analysed for longitudinal loading energy at 5% significance level, the p-value was found to be about 0.01 which shows significant effect of plate. Apparent interaction between longitudinal energy and plate thickness has been observed. Further, it was observed that geometrical shapes of ROPS have no significant effect (p = 0.4) on transverse loading. Furthermore, when the effect of transverse loading energy was analysed in terms of the plate thickness, there was no significant effect found since p-value was 0.1. ANOVA for Vertical force showed that there was no significant effect of shape and plate thickness on the vertical loading. The ROPS A, C and D indicate a very weak interaction as compare to B between plate thickness and vertical loading. During entire standard loading, mounting fixture found to be rigid. There was no sign of failure observed. Moreover, ROPS with developed mounting fixture satisfied the standard ROPS exposure criteria and withstood strong enough. Therefore, it was concluded that developed mounting fixture could be utilized as fitment option for ROPS retrofitting.

Keywords: Mounting fixture, ROPS retrofitting, IS: 11821, Tractors, Rollover