An In-depth Study of Injury Risks due to Cargo Bay Protrusions to Motorised Two-Wheeler Riders

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I. INTRODUCTION

In India, above 150,000 people have died in 480,652 road accidents in 2016 [1]. Among vehicle categories, two-wheelers accounted for the highest share of accidents at 33.8% and are considered as the most vulnerable road users. The total number of two-wheeler occupants who died in these accidents were 52,500 which contributed to 34.8% of total fatalities. As per [2], total number of accidents between Motorised two-wheeler (M2W) and Trucks were 327. Total number of occupants involved in these accidents were 428 of which 25% (106 occupants) were fatal and 71% (302 occupants) were seriously injured. On in-depth accident investigation, it was found that fatalities in collisions between M2W and Trucks due to cargo bay protrusions are 55% which is higher than the overall M2W and Truck accidents fatality rate (25%). In this study, M2W collisions with Trucks/Mini Trucks were studied and the injury outcome due to cargo alternations/extra fitment protrusions is discussed.

II. METHODOLOGY

The police accident data information is not sufficient to do an in-depth analysis of our study. So, this study uses the data from RASSI (Road Accident Sampling System - India) [3] on M2Ws and Trucks involved accidents to analyse injury risks of M2W riders due to impact with truck cargo bay protrusions. RASSI is a comprehensive database based on the format of international databases in the USA, Germany and the UK, but developed for Indian conditions. For the RASSI project, JP Research India Pvt. Ltd. performs on-site crash investigations, collecting detailed accident, vehicle, occupant and road user data and performing vehicle damage coding, accident reconstruction and injury coding. The database is analysed to find out the number of motorised two-wheeler riders who contacted the cargo bay extra fitment protrusions of Trucks, Mini Trucks and Motorised Three-Wheeler - Goods Carriers during the collision and their injury severities. The helmet effectiveness during the collision is also analysed in this study.

Fig. 1. Example to show the alterations/ extra fitment protrusions on cargo bay

III. INITIAL FINDINGS

Under RASSI project, the team has investigated over 3,500 accidents from April 2011 to March 2017; 2,336 accidents were in-depth investigated accidents across India. Of these accidents, 26 cases were of M2W occupants who contacted the cargo extra fitment protrusions and sustained injuries and all these cases happened in the Coimbatore district. Out of 38 occupants (26 riders, 12 pillion riders) who were involved in these 26 accidents, 55% of occupants (18 riders, 3 pillion riders) were fatal and 32% of occupants (7 riders, 5 pillion riders) sustained serious injuries (Figure2).

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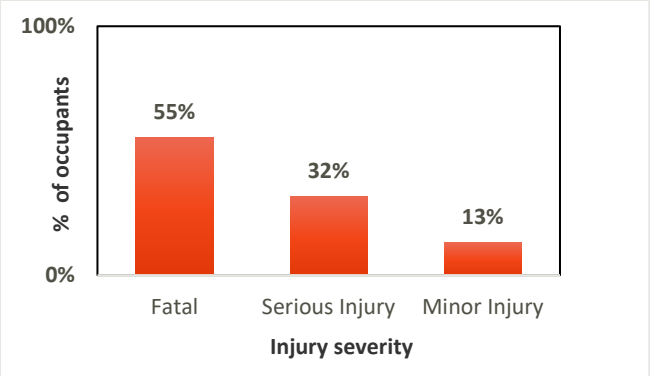

Fig. 2. Distribution of injury severity

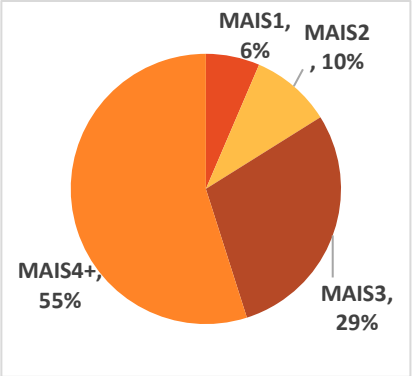

Fig. 3. Distribution of MAIS

Injuries sustained by the victims were analysed and it was found that 84% of them sustained injury severity Maximum Abbreviated Injury Scale (MAIS) 3 and greater than that. Injuries sustained by the victims were scaled using the Abbreviated Injury Scale (AIS 2008). As shown in Figure 3, 84% of victims sustained MAIS3+ injuries.

On further analysis, those injuries sustained by different body regions were identified. MAIS3+ injuries in the head were 80%, lower extremity was 12%, thorax 6% and 3% facial injuries (Figure 4). Only 11% of the M2W occupants wore helmets in these accidents. It was found that most of the helmets worn in these cases were non-certified for ISI standards. When the helmeted occupant impacts the cargo bay protrusions, concentrated point load acts on the helmet which causes it to break open as shown in Figure 5. The protrusions further penetrate and causes head injuries to the occupants. In fact, 71% of total MAIS3+ injuries sustained by helmeted riders were to the head.

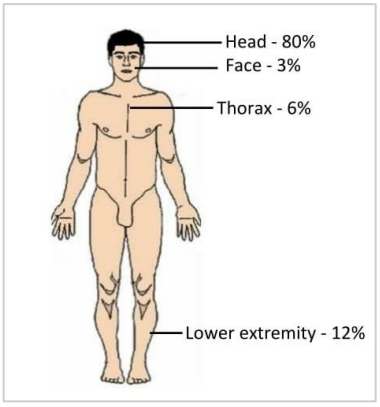

Fig. 4. MAIS2+ injuries body region

Fig. 5. Damaged helmet

IV. DISCUSSION

The analysed results show that cargo bay protrusions are most vulnerable to M2W riders in head-on and sideswipe impacts. Truck owners make these alterations to cargo bays to secure the cargo properly as the hooks, if provided by the Original Equipment Manufacturers (OEM), are too small for tying and knotting thicker ropes. OEMs should get the customer feedback and improve the hook and cargo bay design so that utility is not compromised. Stringent vehicle design regulations should be implemented to monitor the modifications carried out so that these alterations do not pose a risk to other road users. Further, the poor performance of helmets during these impacts highlights the need for stringent laws and standards to be followed in helmet manufacturing.

V. REFERENCES

[1] Transport Research Wing (Ministry of Road Transport and Highways, Government of India) Road Accidents in India – 2016.

[2] Coimbatore Rural Police Accident data January-December 2016.

[3] N. Rameshkrishnan, IRCOBI, 2013