Real World Accident Analysis of Truck Front Impact to Pedestrians

Pradeep Puthan, Rikard Fredriksson, Stefan Thorn, Fredrik Törnvall

I. INTRODUCTION

At present, there is substantial attention towards safety measures for pedestrians in cars with both active and passive safety systems on the market. However, this has not progressed in the same pace for heavy vehicles (total weight above 3,500 kg) with few systems seen on the market. Almost 30% of those who died in 2013 in road accidents that involved buses or coaches in Europe were pedestrians and 17% involved heavy goods vehicles [1]. Pedestrian fatalities were the second most common after car occupants in accidents with heavy vehicles in Europe. This real world accident data shows the seriousness of the current situation. Hence, an effort has been made to understand pedestrian accidents against front-end of trucks above 3,500kg.

II. METHODS

The intention of the study was to understand injury mechanism and injury causing components when pedestrians interact with a truck. For this study, the German In-Depth Accident Database (GIDAS) has been considered (from 1999-2015 June), which had a total of 29,959 accident records. Further study focused on impact velocity, injury sources and their influence on injury severity (AIS1998). Injury sources were grouped as *Front surface of the vehicle, Ground/other objects, Rear view mirror of opponent, Run over, Wheel of opponent*. For an improved understanding, separate statistics were extracted including and excluding run over cases. As a first step, data has been filtered for truck/bus (total weight exceeding 3,500kg) vs pedestrian accidents, which resulted in 148 accidents (151 pedestrians). Out of this, 39 cases were run over type of accidents. Accidents where one pedestrian was impacted by more than one vehicle were excluded to reduce complexity.

III. INITIAL FINDINGS

Out of 148 accidents (heavy vehicles vs pedestrians), 90 cases were pedestrian vs truck. It was found that the truck front was involved in 61 cases. There were 215 AIS3+ injuries from 27 accidents with 28 pedestrians and 280 AIS2+ injuries involving 45 pedestrians in 43 accidents. Approximately 75% of trucks involved in these accidents weighed more than 7,500kg. Figure 1 shows a high percentage of accidents (run over cases included) in 1-10 km/h, 21-40 km/h and in 61-70 km/h ranges. With run over cases excluded, the percentage of 1-10 km/h and 21-30 km/h ranges decreased while the percentage of 61-70 km/h range increased.

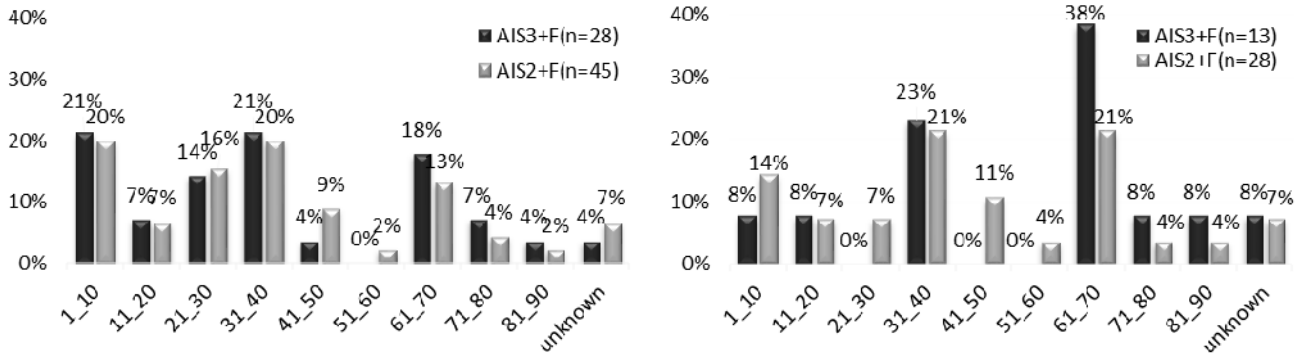

Figure1. Distribution of impact velocity including (left), and excluding (right), run over cases.

Further looking exclusively at the non-run over cases, the head is the most frequently injured body region,

P. Puthan is Senior Accident Research Engineer with Autoliv India Pvt. Ltd, Bangalore, India. R. Fredriksson, PhD, is a Senior Specialist at Autoliv Research in Sweden. S. Thorn and F. Törnvall are Technology Specialists at Volvo Group Trucks Technology, Gothenburg, Sweden.

followed by the thorax and lower extremities (Figure 2). Figure 3 shows that 40% of AIS3+ injuries are caused by components in the vehicle front.

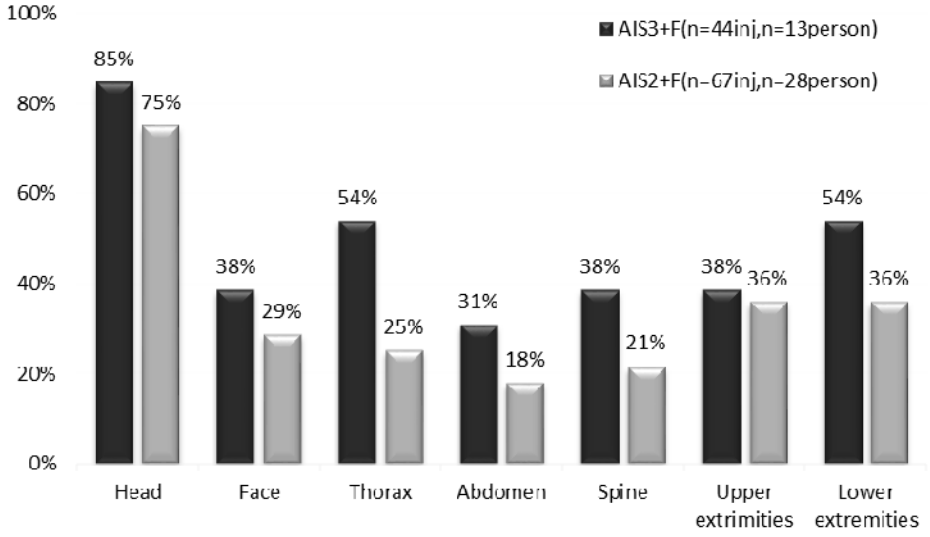

Figure 2. Frequency of pedestrians sustaining injury to given body region (excluding run over cases)

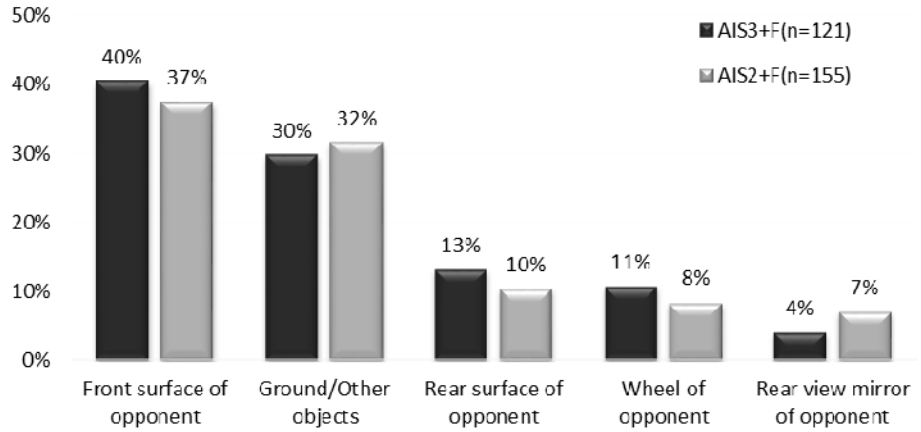

Figure 3. Distribution of pedestrian injury sources (excluding run over cases)

IV. DISCUSSION

This study indicate that 67% of truck vs pedestrian accidents are frontal accidents and 76% of trucks involved weigh more than 7,500kg. The predominant impact velocity in terms of injury was found to be 61-80km/h for the non-run over cases. Head and thorax injuries were dominating, with the front of the truck as the dominant injury source. The next step of this study is to consider wrap around distance of pedestrians to gain profound understanding of impact points on trucks. This approach will help reduce injury by passive solutions through energy management such as design of the truck front-end. Moreover, an in depth study on impact velocity, stopping distance, VRU visibility and accident scenario will give important input to design driver assistance solutions like warning systems or emergency braking. Additionally, this will help to minimise run over cases as well.

V. REFERENCES

[1] European Commission, Traffic Safety Basic Facts on Heavy Goods Vehicles and Buses, European Commission, Directorate General for Transport, June 2015