

Relationship Between Bonnet Leading-edge Height and Pedestrian Torso Injuries Using In-depth Crash Data

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Pedestrians account for a large proportion of traffic fatalities in Japan. In fatal pedestrian crashes, head injuries are the most common. Thoracic and pelvic injuries are also frequently observed, and reducing torso injuries is an important safety issue. It has been reported that pedestrian kinematics and injury outcomes are influenced by the relative position between vehicle front-end height and pedestrian pelvic height. Therefore, this study investigated the relationship between bonnet leading-edge height and torso injuries using Japanese in-depth crash data.

The analysis was conducted using ITARDA in-depth crash data collected between 2018 and 2023. Crash cases with a MAIS (Maximum Abbreviated Injury Scale) ≥ 2 were included, and cases involving cab-over vehicles were excluded. The torso consisted of the thorax, abdomen, spine (excluding the cervical spine), and pelvis. Cases were classified into a High Group, in which the bonnet leading-edge height exceeded the pedestrian greater trochanter height, and a Low Group, in which it was lower.

A total of 57 crash cases were included in the analysis, with 24 cases in the High Group and 33 cases in the Low Group. Compared with the Low Group, the High Group showed a higher proportion of crash cases involving AIS (Abbreviated Injury Scale) ≥ 2 injuries in the torso, as well as in the thorax, abdomen, spine, and pelvis (Fig. 1). In addition, the High Group exhibited a lower proportion of wrap trajectories and a higher proportion of forward/lateral projection trajectories (Fig. 2). These findings suggest that bonnet leading-edge height is associated with pedestrian kinematics and torso injuries.

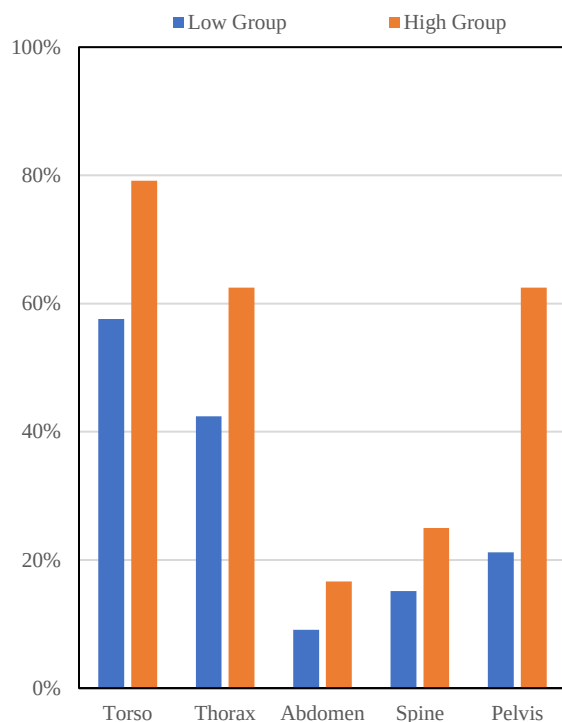


Fig. 1 Percentage of crashes with MAIS ≥ 2 in the torso, thorax, abdomen, spine, and pelvis by vehicle height category

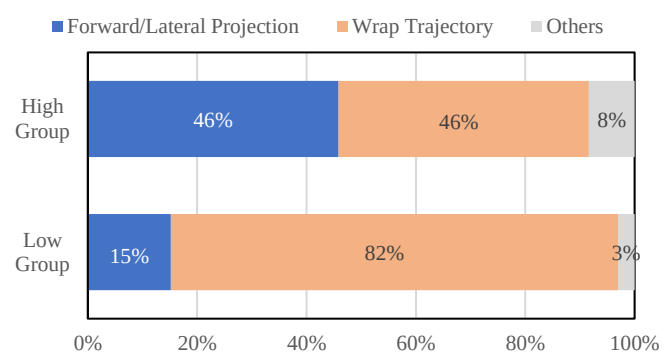


Fig. 2 Distribution of pedestrian post-impact kinematics by vehicle height category