

Relative Position of a Pedestrian After Collision With Respect to the Vehicle's Stopping Position

Mototsugu Suzuki ¹⁾ Tetsuya Nishimoto ¹⁾ Tomokazu Motomura ²⁾

*1) College of Engineering, Nihon University
1, Nakawahara Tokusada, Tamura -machi, Koriyama, Fukushima, 963-8642, Japan (E-mail: cemo16001@gmail.com)
2) Nippon Medical School Chiba Hokusyo Hospital,
1715 Kamagari, Inzai, Chiba, 270-1694, Japan*

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Traffic accidents remain a serious social issue, and pedestrian collisions are particularly critical because traffic-vulnerable individuals are more likely to sustain severe injuries. In recent years, the installation of front and rear cameras on vehicles has become widespread, with the penetration rate of drive recorders reaching 53.8%. This trend indicates the rapid expansion of in-vehicle camera utilization. In addition, pedestrian detection technologies using rear-view cameras have advanced, and these cameras have potential applications in accident scene assessment and emergency medical response. Understanding whether pedestrians tend to fall in front of or behind the vehicle after impact is essential for designing life-saving support systems that utilize in-vehicle cameras. Therefore, this study conducted a fundamental investigation aimed at enhancing the applicability of in-vehicle cameras in emergency response by organizing pedestrian landing points after collisions, based on the vehicle's post-impact stopping position.

The study examined 18 pedestrian-vehicle collision cases that occurred between 2021 and 2022, in which the distance and forward/backward direction between the vehicle's stopping position immediately after the accident and the injured pedestrian's landing point could be estimated. For classification of landing points, the vehicle's final stopping position after the accident was used as the reference, and the relative position from the vehicle was categorized into two regions: "front" and "rear." Distances from the vehicle were measured from the front end of the vehicle. In addition to on-site investigation results, Google Maps aerial imagery was used in some cases to measure distances based on roadway width and crosswalk dimensions at the accident location.

Fig.1 shows the distribution of pedestrian landing points and distances from the vehicle, referenced to the vehicle's stopping position immediately after the accident. Although some vehicles had been moved for safety reasons immediately after the collision, cases in which the relative relationship between the vehicle and the landing point could be determined were included in the analysis. While the actual point of impact on the vehicle is not necessarily the center of the front bumper, the front-center point was adopted as a convenient reference for indicating pedestrian landing positions and directions. Distances to landing points were presented based on measured values, and landing directions were organized as approximate directions derived from accident information. From the vehicle's stopping position, landing directions were classified as 7 cases in the front region and 11 cases in the rear region. Distances from the vehicle's front-center point ranged up to approximately 24 m in the front region and up to approximately 39 m in the rear region, with both regions showing broadly similar spreads. In terms of direction, front-region cases were distributed within approximately 45° to the right of the vehicle's front-center point, whereas most rear-region cases were located directly behind the vehicle. Lateral bias differed between regions: front-region cases tended to cluster toward the right, while rear-region cases showed minimal lateral bias, with many landing points located near the vehicle's centerline at its final stopping position.

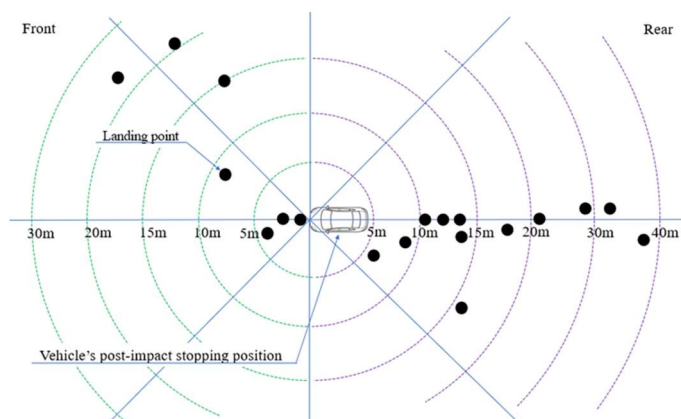


Fig.1 Pedestrian Landing Points Relative to Vehicle Stopping Position