

Survey on Naturalistic Driving Behavior of Motorcycles on Hilly and Mountainous Roads

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One of the factors contributing to the stagnation in the reduction of traffic accidents in Nagano Prefecture is the increasing number of single-vehicle motorcycle accidents involving middle-aged and older riders from outside the prefecture. In this study, the naturalistic driving behavior of riders on hilly and mountainous roads was investigated to examine factors contributing to single-vehicle motorcycle accidents. In particular, the lean angles of motorcycles in cornering on hilly and mountainous roads were analyzed.

The lean angles were measured using camera-based image analysis. The vehicle body lean angle was defined as the angle between the horizontal line and the line connecting the ends of the handlebars (front view), or the angle between the vertical line and the line connecting the center of the taillight and the center of the rear wheel (rear view). The upper body lean angle was defined as the angle between the horizontal line and the line connecting the rider's shoulders. Based on motorcycle single-vehicle accident data in Nagano Prefecture involving middle-aged and older riders from outside the prefecture, three survey locations were selected in the Suwa area in Nagano Prefecture considering large, medium, and small curve radii. The maximum radii of curvature at the three locations were 34 m, 59 m, and 116 m, respectively.

The results revealed differences in vehicle body lean angle and rider upper body movement depending on the curve direction and curvature. Although no significant differences were found, a tendency was observed in which the vehicle body lean angle was smaller and the rider's upper body was more upright on left curves compared with right curves as shown in Figure 1. The left curves exhibited a more upright upper body posture, particularly on a smaller curve (Figure 2). Furthermore, on smaller curves, riders tended to ride to the left of the own lane centerline on left curves and to the right on right curves as shown in Figure 3. This behavior is attributed to riders anticipating outward drift relative to the direction of travel in cornering. However, on left curves, the proximity of physical obstacles such as guardrails or walls can create a sense of pressure, making it difficult to lean the vehicle fully. Consequently, riders tend to maintain a more upright upper body than on right curves. This insufficient lean angle in cornering may be one of the factors contributing to motorcycle accidents on left curves.

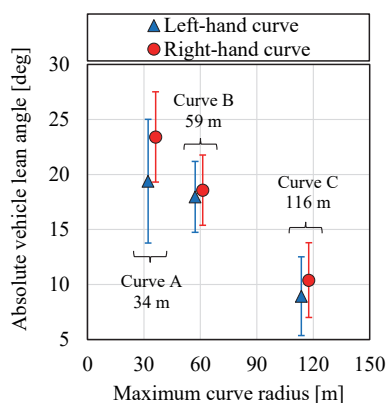


Fig.1 Average vehicle body lean angle by curve radius and direction

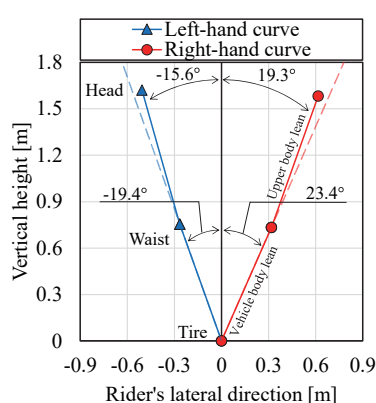


Fig.2 Average rider posture (rear view) Curve A (R=34 m)

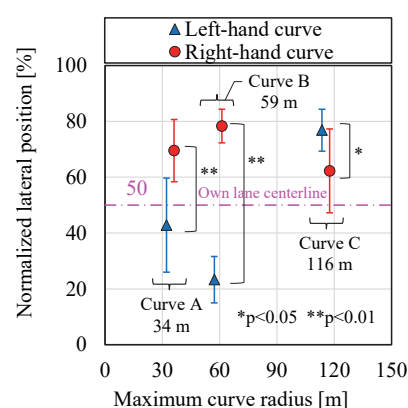


Fig.3 Rider lateral position by curve radius and direction