

Exploring Proficiency-Related Indicators in Driver Behavior While Crossing Intersections

**Murakami Takuya¹⁾ Matsuki Yuji²⁾ Myojin Takara³⁾ Kojima Taichi¹⁾ Omote Asako¹⁾
Nakamura Yudai¹⁾**

1) Advanced Technology R&D Center, Mitsubishi Electric Corporation, 8-1-1 Tsukaguchi-Honmachi, Amagasaki, Hyogo 661-8661, Japan, (E-mail:Murakami.Takuya@dx.MitsubishiElectric.co.jp)

2) Fukuoka Institute of Technology, 3-30-1 Wajiro-higashi, Higashi-ku, Fukuoka, 811-0295, Japan

3) Mitsubishi Electric Mobility Corporation, 7-3 Marunouchi 2-Chome, Chiyoda-ku, Tokyo, 100-0005, Japan

KEY WORDS:Human Engineering, Driver Behavior, Behavior Observation, Virtual Reality, Intersection [C2]

This study focuses on driving behavior during intersection approach and traversal. The purpose is to explore candidate indicators for evaluating driving proficiency. From the perspective of safe driving, it is difficult to quantitatively evaluate driving proficiency. Driving history and driving frequency are considered to be related to proficiency. However, driving proficiency may also be influenced by factors such as age, traffic exposure, cognitive function, and visual function. Therefore, safety cannot be explained by years of driving experience alone.

In this study, a VR driving environment was used. Four university students participated as novice drivers, and two driving school instructors participated as experienced drivers.

The driving route contained four four-way intersections. Two visibility conditions were prepared. One was the wall-obstructed condition, referred to as the With Wall condition, in which walls were placed near the intersections. The other was the unobstructed condition, referred to as the No Wall condition, in which no walls were present near the intersections. Each participant drove under both conditions, with the order of conditions counterbalanced across participants. During driving, gaze direction, vehicle speed, pedal inputs, vehicle position, and eye openness were recorded.

In the analysis, left-right checking count, gaze scanning range, peak brake input, and eye-openness indices were compared. Left-right checking count was defined as the number of large gaze movements to the left or right before entering an intersection. Peak brake input was defined as the maximum brake input recorded near an intersection.

Under the No Wall condition, both groups showed decreases in left-right checking count and gaze scanning range. The decrease was especially large in the student group (Fig. 1). In contrast, the instructor group retained a relatively high level of checking behavior even under the unobstructed visibility condition. This result suggests that visual checking behavior may be more habitual among experienced drivers.

Differences were also observed in brake input (Table 1). Peak brake input was smaller in the instructor group than in the student group, regardless of whether an NPC vehicle emerged at the intersection. In addition, the variation in peak brake input across visibility conditions was smaller in the instructor group. This suggests that braking behavior was more consistent across situations in the instructor group. However, the overall brake-input level was also lower in the instructor group. Therefore, the apparent group difference in variation may partly reflect differences in the scale of brake input.

Regarding eye openness, mean eye openness decreased, and the low-eye-openness rate and blink rate increased in the With Wall condition in both groups. These results suggest that visual search load or tension may have increased at intersections with obstructed visibility. Therefore, these indices should not be interpreted as direct evidence of cognitive load.

In summary, driving proficiency may be reflected not only in visual checking behavior but also in the magnitude of brake input and the situational consistency of vehicle-control inputs. Because only four students and two instructors participated, all group comparisons were reported descriptively without statistical testing, and the results should be regarded as exploratory. Future work should increase the number of participants and examine the relationship between these behavioral indicators and safety-related measures.

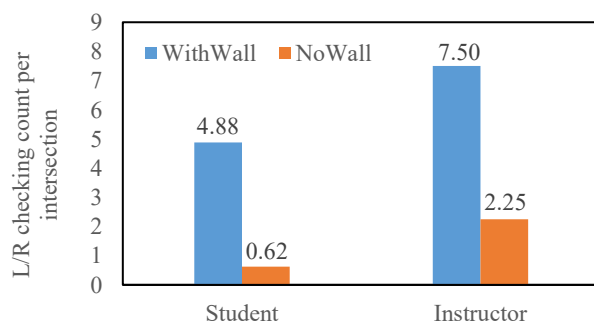


Fig.1 L/R checking count

Table.1 Brake Pedal Depression (Proficiency)

Group	Condition	B _{NPC}	B _{noNPC}	Mean ΔB
Student(s01~s04)	No Wall	0.654	0.788	0.230
Student(s01~s04)	With Wall	0.502	0.657	0.247
Instructor(s05,s06)	No Wall	0.311	0.253	0.058
Instructor(s05,s06)	With Wall	0.333	0.375	0.042