

Effects of Pedal Characteristics of Electric Vehicles on Driving Operation of Elderly People

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In recent years, the number of electric vehicles has increased all over the world and is expected to grow rapidly in the future. Electric vehicles are characterized by smooth acceleration due to the strong motor torque and rapid deceleration due to regenerative braking. These vehicles can accelerate and decelerate more quickly than conventional gasoline engine vehicles, and a few can even decelerate to a stop using only regenerative braking without using hydraulic brakes. Such operability may cause discomfort to elderly drivers who have been using gasoline engine vehicles for several years. In particular, elderly drivers with impaired cognitive and physical functions may not be able to adapt to the operation of electric vehicles. Therefore, this study investigated the effects of pedal operation characteristics of electric vehicles on the driving behavior of elderly drivers in driving experiments using a driving simulator (DS). Additionally, the safety function required for electric vehicles is discussed.

Driving behavior on DS was observed under the constant velocity condition, which required the drivers to maintain a specified vehicle velocity (55 km/h), and in the velocity change tracking condition that required the repeated velocity adjustment in line with changes in the velocity with changing speed in the range 0 to 60 km/h of surrounding vehicles.

Based on the average error from the target velocity under the constant velocity condition, the standard deviations of many elderly drivers were larger when they drove electric vehicles than when they drove gasoline vehicles. (Fig.1(i)). This was because in electric vehicles, controlling strong acceleration when the accelerator pedal is pressed and rapid deceleration after it is released are both difficult. The recorded video around the foot of such participants showed that they continuously pressed the accelerator pedal until the target velocity reached and released it when it exceeded. In contrast, the small standard deviation in most young participants (Fig.1(ii)) suggested that a constant amount of pressure could be continuously applied to the accelerator pedal.

No significant difference in velocity was observed between the elderly and young participants in the velocity change tracking condition. Approximately half of the young and most of the elderly participants were unable to follow the surrounding vehicle stably. The results of the questionnaire on daily driving and interest in automobile technology suggested that pedal operation may become unstable for drivers who drive less frequently and have less interest in automotive technology.

With these experiments, we observed that in an electric vehicle that can accelerate and decelerate only with the accelerator pedal, the percentage of those who operate the accelerator pedal frequently and have a large amount of operation is higher in the elderly than in the young drivers. Such drivers may cause the vehicle's velocity to become unstable. Therefore, reducing the acceleration torque and weakening the deceleration control in the electric vehicle is necessary for stable driving.

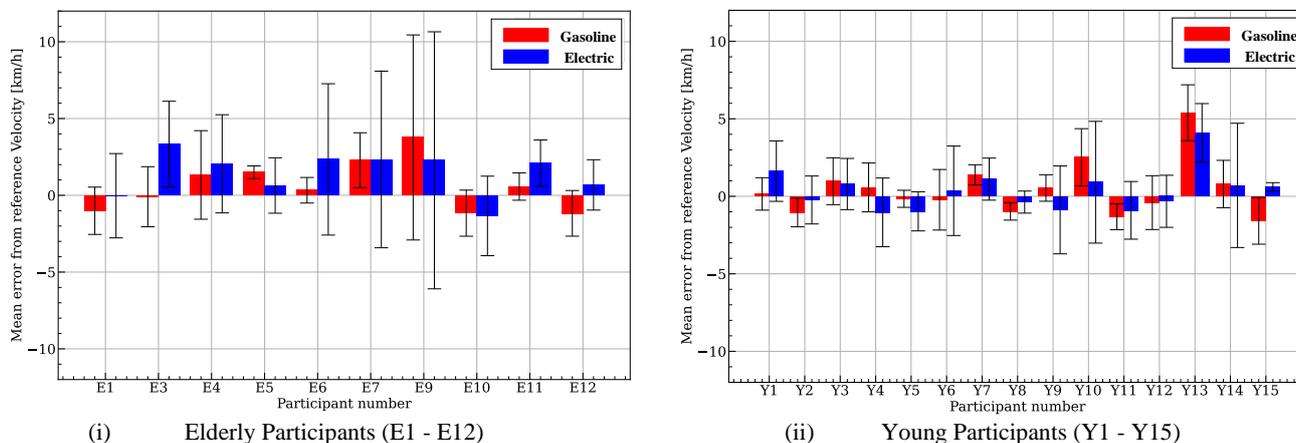


Fig.1 Mean error from the reference velocity and own velocity for constant velocity condition