New Method for Distance-based Close Following Safety Indicator

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Objective: The increase in the number of fatalities caused by road accidents involving heavy vehicles every year has raised the level of concern and awareness on road safety in developing countries like Malaysia. Changes in the vehicle dynamic characteristics such as gross vehicle weight, travel speed, and vehicle classification will affect a heavy vehicle’s braking performance and its ability to stop safely in emergency situations. Thus, the aim of this study is to establish a more realistic new distance-based safety indicator called the minimum safe distance gap (MSDG), which incorporates vehicle classification (VC), speed, and gross vehicle weight (GVW).

Method: Commercial multibody dynamic simulation software was used to generate braking distance data for various heavy vehicle classes under various loads and speeds.

Results: By applying nonlinear regression analysis to the simulation results, a mathematical expression of MSDG has been established. The results show that MSDG is dynamically changed according to GVW, VC, and speed.

Conclusions: It is envisaged that this new distance-based safety indicator would provide a more realistic depiction of the real traffic situation for safety analysis.

Keywords: heavy vehicle, gross vehicle weight (GVW), distance-based safety indicator, close following, vehicle type/classification

Introduction

Road accidents over the past decade in developing countries like Malaysia showed worrying trends. In 2010, there were about 41,442 cases of road accidents recorded compared to only 16,031 cases in 1995 (Department of Statistics Malaysia 2010). Statistics also showed an increase in number of fatalities from 5,712 to 6,872 over the same period. The casualties resulting from accidents involving heavy vehicles accounted for 25% of total road fatalities. It should be noted that the percentage represents fatalities of vehicle operators, which includes drivers, co-drivers, and/or assistants. Although the number of registered heavy vehicles barely makes up 3% of total registered vehicles in Malaysia, the composition of heavy vehicles in the traffic stream may reach 20% of all traffic on the road (depending on location). This suggests that the percentage of fatalities involving heavy vehicles with other road users is much higher than the existing statistics. Because heavy vehicles vary in type and size, the gross vehicle weight (GVW) varies considerably, especially when loaded. This situation is more serious when overloading exists.

Road accident statistics have consistently shown that driver errors and misbehavior are the main contributing factors of traffic crashes. Human behavior, the roadway environment, and vehicle failure are factors found to contribute approximately 94, 34, and 12% of crashes, respectively (Evans 1991). Human factors involved in traffic crashes can be subdivided into 4 groups: (1) following too closely, (2) failing to grant right of way, (3) driver losing control, and (4) speeding, causing 30, 7, 13, 9, and 10.60%, respectively, of the crashes involved (Evans et al. 2012).

The most common critical error made by drivers, whether they are heavy vehicle operators or other involved drivers, appears to be following too closely or misjudging the distance gap between 2 vehicles or more, which happened when the driver follows a vehicle too closely and is overconfident in his ability to stop the heavy vehicle without colliding. The driver’s consciousness of the safe distance gap is crucial for heavy vehicle drivers to prevent collision with the vehicle in front. Therefore, some countries have imposed rules and practices concerning the minimum time gap allowed between 2 vehicles on the road to prevent front-end and rear-end collisions (Hutchinson 2008).