

THE RELATIONSHIP BETWEEN SPEED DIFFERENTIAL AND TIME TO COLLISION OF MALAYSIAN EXPRESSWAYS

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Abstract

Lane change (LC) manoeuvre has been recognized as an important aspect of driving behavior that significantly impacts traffic operation and management. Incorrect LC execution, particularly incorrect gap distance selection before the LC movement, can lead to traffic accidents, most often in the form of a rear-end, sideswipe, or angled collision. This paper investigates the relationship between time to collision and the speed differential between the leading and following vehicles when lane change occurs. Using an instrumented vehicle method, data was gathered along a typical length of the Kuala Lumpur-Seremban expressway. A VBox (Video Velocity Box) is an on-board data collection device that is used to videotape traffic incidents on the road, was installed in a passenger car. In a three-day period, a total of 175 instances of lane changing were documented. Following gap distance was used to calibrate the VBox equipment as a measure of efficiency. A simple linear regression was conducted between time to collision (TTC) and speed differential. It was found that 60% and 75% of drivers have TTC fewer than 5 sec and 10 sec, separately, with 6.10 sec average TTC. The time to collision (TTC) has a negative linear relationship with speed differential ($R^2 = 84.47\%$). The finding shows that the higher the speed differential between vehicles, the lower the TTC value, which indicates a higher probability of collisions. It can be concluded that the speed differential between the test car and following vehicles is affecting the TTC, which is to be utilised as a risk indicator throughout lane-changing operation.

Keywords: Lane-changing, TTC, speed differential, instrumented vehicle, risk indicator

Introduction

Recently, there are many research studies have reported high statistics numbers of severe crashes causing due to Lane Change (LC) maneuver on the road (Sen *et al.*, 2003; Naranjo *et al.*, 2008; Suh *et al.*, 2018; Yang *et al.*, 2019; Shawky, 2020).

According to Shawky, abrupt lane changes were responsible for 17.0 percent of all severe collisions between 2010 and 2017 (Shawky, 2020). A total of 13939 fatal collisions occurred during an overtaking maneuver in the USA from 1994 to 2005, according

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