Available online at www.CivileJournal.org

Civil Engineering Journal

Vol. 3, No. 7, July, 2017

Analyzing Microscopic Behavioral between Two Phases of Follower and Leader in Traffic Oscillation with Developing Artificial Neural Networks

Babak Mirbaha [a*], Ali Abdi Kordani [a], Arsalan Salehikalam [b], Farzad Akbarinia [b], Mohammad Zarei [b]

[a] *Assistant Professor, Faculty of Engineering, Imam Khomeini International University, Qazvin, Iran.*

[b] *PhD candidate, Imam Khomeini International University, Qazvin, Iran.*

Received 04 July 2017; Accepted 05 August 2017

Abstract

A Sudden speed drop in the leader vehicle of vehicle platoon results in propagating the deceleration wave from downstream towards the upstream flow. Points of wave propagation of the leader vehicle towards the follower vehicle identification are done based on Newell's theory in trajectory data. Deceleration wave propagates based on two parameters, time and space, τ- δ. A follower driver performs different behavioural reactions that they result in deviating follower driver from Newell's trajectory. In this paper, follower driver behaviour was identified based on two theories. The asymmetric microscopic driving behaviour theory and traffic hysteresis were used during the deceleration and acceleration phases, respectively. The data trajectories were classified into different traffic phases. Driver's parameters were identified at the microscopic level. Since the follower driver had the nonlinear behaviour, artificial neural networks were developed. They were able to analysis and identify effective parameters of dependent variable between deceleration phases leading to congestion phase, based on the behavioural patterns. Analysis results present effective parameters based on any behavioural patterns. Spacing difference of two phases, deceleration and congestion phases, was the most effective parameter of both two behavioural patterns, under reaction – timid and over reaction – timid. Increasing the spacing difference of two phases results in decreasing (increasing) time based on under reaction – timid (over reaction – timid).

Keywords: Stop–Go Traffic; Behavioural Patterns; Time between Two Phases; Deceleration Phase; Congestion Phase; Artificial Neural Networks.

1. Introduction

Stop and go traffic is frequently observed in congested freeway, unfortunately our understanding of traffic oscillation is not enough. When vehicle platoon enters the traffic oscillation, a follower driver presents different reactions in F service. When a leader vehicle develops sudden speed drop, it results in propagating deceleration wave in vehicle platoon. Stop – go traffic develops negative effects such as: travel delay, wasted energy and safety risks. Different reasons, lane change maneuvers and traffic moving bottleneck, leads to form and propagate an oscillation wave in traffic [1-10]. Stop – go waves grow or disappear in vehicle platoon based on vehicle models or lane change maneuvers [11] and [12]. Various behavioral characteristics of stop – go traffic result in the necessity of identifying and understanding congestion traffic. There is a need to the trajectory data in order to estimate different effects of traffic. Newell proposed the first theory of follower different behavior based on separating speed – spacing of deceleration and acceleration phases. Based on Newell's theory, spacing of acceleration phase is more than deceleration phase [13]. Also, Newell

* Corresponding author: mirbaha@eng.ikiu.ac.ir