Available online at www.CivileJournal.org

Civil Engineering Journal

Vol. 4, No. 3, March, 2018

Evaluating the Relationship between Operating Speed and Collision Frequency of Rural Multilane Highways Based on Geometric and Roadside Features

Behzad Bamdad Mehrabani [a], Babak Mirbaha [b*]

[a] MSc. in Transportation Engineering, Faculty of Engineering, Imam Khomeini International University, Qazvin, Iran.

[b] Assistant Professor, Department of Transportation and Planning, Faculty of Engineering, Imam Khomeini International University, Qazvin, Iran.

Received 27 January 2018; Accepted 18 March 2018

Abstract

Speed is one of the main functional factors that affect road safety in terms of both collision occurrence and collision severity. Previous studies have shown that several roadside and geometric features affect road safety and operating speed. This paper aims to evaluate the effects of roadside and geometric features on operating speed and collision frequency, simultaneously. For this purpose, the operating speed data of 103 segments along with their accident data and roadside and geometric characteristics were collected. Structural equation modelling (SEM) with latent variables was employed to model operating speed and collision frequency, simultaneously. Two latent variables including "geometric effect" and "roadside effect" were defined in SEM. The first latent variable is the combination of the natural logarithm of the segment length, longitudinal slope, the presence of a 2-meter paved shoulder, and curvature of the segment. The indicators of the second latent variable are the number of accesses and the presence of residential land use. The results show that the latent variable "roadside effect" increases collision frequency by a standard regression weight of 3.455; however, it reduces operating speed by a standard regression weight of –0.385. Also, the latent variable "geometric effect" causes an opposite effect on collision frequency and operating speed by the standard regression weight of –5.313 and 0.730, respectively. Besides, lower operating speed causes a reduction in the collision frequency by the standard regression weight of 7.734. The results of this study can be useful for designers and road safety agencies to improve road safety.

Keywords: Operating Speed; Collision Frequency; Geometric Features; Roadside Features; Structural Equation Modeling.

1. Introduction

Speed is one of the main functional factors that affect road safety, which affects both collision occurrence and collision severity [1]. According to statistics of World Health Organization [2], one-third of road accidents occur due to speed. Therefore, the relationship between speed and safety is a demanding research interest. Many researchers have reported that increasing vehicle speed is accompanied by increasing crash severity or probability of crash occurrence [1, 3-6]. However, few studies have shown a negative relationship between speed and crash occurrence [7].

Vehicle speed is among the most important and complicated factors during driving that may confuse drivers. As a result, road safety prediction depends on the operating speed more than the posted speed limit. In many cases, the operating speed is higher than the posted speed limit. Therefore, operating speed is an effective representation of drivers' behavior on a given road.

Concepts related to operating speed are defined in different ways, with the best proposed by the AASHTO green

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

http://dx.doi.org/10.28991/cej-0309120