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Multi-Level Crash Prediction Models Considering Influence of Adjacent Zonal Attributes

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Abstract

This study investigates factors affecting accidents across transport facilities and modes, using micro and macro levels variables simultaneously while accounting for the influence of adjacent zones on the accidents occurrence in a zone. To this end, 15968 accidents in 96 traffic analysis zones of Tehran were analyzed. Adverting to the multi-level structure of accidents data, the present study adopts a multilevel model for its modeling processes. The effects of the adjacent zones on the accidents which have occurred in one zone were assessed using the independent variables obtained from the zones adjacent to that specific zone. A Negative Binomial (NB) model was also developed, and results show that the multilevel model that considers the effect of adjacent zones shows a better performance compared to the multilevel model that does not consider the adjacent zones' effect and NB model. Moreover, the final models show that at intersections and road segments, the significant independent variables are different for each mode of transport. Adopting a comprehensive approach to incorporate a multi-level, multi-resolution (micro/macro) model accounting for adjacent zones' influence on multi-mode, multi-segment accidents is the contribution of this paper to accident studies.

Keywords: Multi-Level Model; Adjacent Zone; Crash Frequency; Micro/Macro Variable.

1. Introduction

Accidents are and have always been regarded as one of the sad consequences of transportation systems. In 2015, 19.9 people out of each 100000 have died in accidents in Iran; compared to 5.1 casualties in Europe [1, 2]. Hence, the necessity of paying more attention to transportation safety and carrying out pertinent investigations seems unavoidable. Since the nature and mechanism of accidents varies across diverse transportation facilities, it is essential to run separate investigations on the accidents of each mode. The studies done over the recent years have mostly addressed accidents of all modes together or have considered only a single mode (vehicle, motorcycle and pedestrian) [3]. This has led to an inaccurate understanding of the factors affecting accidents since one factor might increase accidents in one mode while decreasing them in the other. Therefore, the significance of reaching an accurate understanding of the factors leading to accidents necessitates separate investigation of accidents across different transportation modes and facilities.

Most of the previous studies on transportation safety have addressed micro-level factors which are related to accidents such as road geometry or the road lighting quality. Most of them are carried out at the operation time of transport

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