8th National Congress on Civil Engineering, 7-8 May 2014
Babol Noshirvani University of Technology, Babol, Iran

# Transportation Safety Modeling Considering Land-Use Type

**Pooya Najaf[1], Jean-Claude Thill[2]**

**1- Research and Teaching Assistant, INES Ph.D. Candidate, University of North Carolina at Charlotte, NC, USA**

**2- Knight Foundation Distinguished Professor, Department of Geography & Earth Sciences, University of North Carolina at Charlotte, NC, USA**

1- pnajaf@uncc.edu
2- jean-claude.thill@uncc.edu

**Abstract**

Transportation safety planning is effective in reducing direct costs of crashes (e.g., injuries, fatalities, financial losses and delays) as well as indirect costs (e.g., wasting energy, missing workforce in the society, and economic and psychological consequences). Since different types of land uses are associated with different driving behaviors, pedestrian activities, transportation modes, demographic characteristics, traffic flow and roadway conditions, it is vital for practitioners to consider the transportation safety related countermeasures for each type of land use separately. In this research, data for 1,398 segments of the city of Charlotte, North Carolina is used to model crash frequency and then models are validated using data for 352 segments. First, the crash data is clustered into different homogenous groups using Two-Step Cluster Analysis to evaluate the effectiveness of land-use type in categorizing the crash data into the different levels of safety. Then, Negative Binomial Regression (NBR) models are developed for residential, commercial and industrial land uses separately as well as for the entire set of samples including all types of land uses. Significant variables are then compared across these three categories (land uses) to identify the role of different factors (such as traffic volume, congestion ratio, speed limit, number of lanes, condition of parking on the roadside, etc.) in reduction of crashes for each type of land use. Based on the final results of the modeling procedure, recommendations are made to increase transportation safety considering the type of land use.

**Keywords: Land Use, Crash Frequency, Safety Planning, Negative Binomial, Two-Step Cluster Analysis**

## 1. INTRODUCTION

Accident prediction models have paved the way for identifying and evaluating factors associated with crashes to improve transportation safety and reduce various direct and indirect costs of traffic crashes on the society. Transportation safety researchers study different potential factors using new data-based methodologies to identify the effective attributes and best techniques to model traffic safety. Among different types of traffic safety models, crash frequency prediction models have gained more attention among operators, planners and practitioners because of their ability not only to predict the number of crashes, but also to evaluate the effect of each attribute on transportation safety planning.

As discussed in several other pieces of research [1], transportation network characteristics (i.e., roadway characteristics, traffic flow conditions and environmental characteristics) feature among the main effective factors of crash frequency and consequently have a direct relationship with transportation safety planning. On the other hand, different types of land uses are associated with different driving behaviors, transportation modes, number of trips, demographic characteristics, roadway characteristics, traffic flow conditions, pedestrian activities and so on [2]. These transportation related differences necessitate the consideration of land-use characteristics (especially the land-use type in this research) in transportation safety analysis.

The main objective of this research is to evaluate the effect of land-use type on crash frequency and accordingly in transportation safety planning. The main advantage of this research over the past studies is in considering the land-use type not only as an independent variable in the general crash frequency models (i.e., to study the effect of this attribute on the number of crashes), but also as a control variable (i.e., to divide the entire dataset into different categories based on their land-use type and then develop models for each category). These two different levels of modeling facilitate: a) evaluating the significance of the land-use type variables while they are used with other aforementioned variables (e.g., transportation network characteristics) in crash frequency models, and b) evaluating the role of each aforementioned attribute (e.g., traffic flow conditions, etc.) on transportation safety in different types of land uses (i.e., residential, commercial and industrial). The first part proves whether land-use type is an effective factor of crash frequency when it is considered as an independent